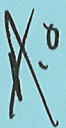


STATE OF NEW HAMPSHIRE

INTER-DEPARTMENT COMMUNICATION

FROM:  Andrew O'Sullivan
Wetlands Program Manager

DATE: 9/20/2019

AT (OFFICE): Department of
Transportation

SUBJECT Dredge & Fill Application
Northwood, 42363

Bureau of
Environment

TO Craig Rennie, Permitting Supervisor
New Hampshire Wetlands Bureau
29 Hazen Drive, P.O. Box 95
Concord, NH 03302-0095

Forwarded herewith is the application package prepared by NH DOT Bureau of Bridge Design for the subject major impact project. This project is classified as major per Env-Wt 303.02(p). The project is located on NH Route 107 in the Town of Northwood, NH. The proposed work consists of the replacement of a 5' high X 7' wide arch corrugated metal pipe carrying Narrows Brook under NH 107 and replacing it with a 5' high X 9' wide box culvert. This application also serves as a required follow-up application for an Emergency Authorization Verification 2019-02481 that involved removing the failed 5' X 7' arch pipe and the installation of a temporary 66 inch x 48 foot long corrugated steel pipe aluminized.

This project was reviewed at the Natural Resource Agency Coordination Meeting on June 19, 2019. A copy of the minutes has been included with this application package. A copy of this application and plans can be accessed on the Departments website via the following link:
<http://www.nh.gov/dot/org/projectdevelopment/environment/units/program-management/wetland-applications.htm>

Mitigation is not required as the project has been deemed self-mitigating.

The lead people to contact for this project are Kirk Mudgett, Chief of Specialty Section, Bureau of Highway Design (271-2731 or kirk.mudgett@dot.nh.gov) or Andrew O'Sullivan, Wetlands Program Manager, Bureau of Environment (271-3226 or andrew.o'sullivan@dot.nh.gov).

A payment voucher has been processed for this application (Voucher # 581756) in the amount of \$516.60.

If and when this application meets with the approval of the Bureau, please send the permit directly to Andrew O'Sullivan, Wetlands Program Manager, Bureau of Environment.

AMO:amo
Enclosures
cc:

BOE Original

Town of Northwood (4 copies via certified mail)
David Trubey, NH Division of Historic Resources (Cultural Review Within)
Bureau of Construction
Carol Henderson, NH Fish & Game (via electronic notification)
Maria Tur, US Fish & Wildlife (via electronic notification)
Mark Kern, US Environmental Protection Agency (via electronic notification)
Michael Hicks, US Army Corp of Engineers (via electronic notification)
Kevin Nyhan, BOE (via electronic notification)
River Local Advisory Committee (via certified mail)



WETLANDS PERMIT APPLICATION

Water Division/ Wetlands Bureau

Land Resources Management

Check the status of your application: www.des.nh.gov/onestop



RSA/Rule: RSA 482-A/ Env-Wt 100-900

Administrative Use Only	Administrative Use Only	Administrative Use Only	File No.:
			Check No.:
			Amount:
			Initials:

1. REVIEW TIME: Indicate your Review Time below. To determine review time, refer to Guidance Document A for instructions.

☒ Standard Review (Minimum, Minor or Major Impact)

☐ Expedited Review (Minimum Impact only)

2. MITIGATION REQUIREMENT:

If mitigation is required, a Mitigation-Pre Application meeting must occur prior to submitting this Wetlands Permit Application. To determine if mitigation is required, please refer to the Determine if Mitigation is Required Frequently Asked Questions.

Mitigation Pre-Application Meeting Date: Month: ___ Day: ___ Year: ____

☒ N/A - Mitigation is not required

3. PROJECT LOCATION:

Separate wetland permit applications must be submitted for each municipality within which wetland impacts occur.

ADDRESS: **NH 107 230' Northwest of High Street.**

TOWN/CITY: **Northwood**

TAX MAP: **N/A**

BLOCK: **N/A**

LOT: **N/A**

UNIT: **N/A**

USGS TOPO MAP WATERBODY NAME: **Narrows Brook**

☐ NA

STREAM WATERSHED SIZE: **3470 AC**

☐ NA

LOCATION COORDINATES (If known): **43.2298 N, -71.2473 W**

☒ Latitude/Longitude ☐ UTM ☐ State Plane

4. PROJECT DESCRIPTION:

Provide a brief description of the project outlining the scope of work. Attach additional sheets as needed to provide a detailed explanation of your project. DO NOT reply "See Attached" in the space provided below.

Replace 5' high x 7' wide cmp arch pipe carrying Narrows BROOK UNDER NH 107, located approximately 230' northwest of High Street. Incidental work includes replacement of a 12" cmp closed drainage pipe at culvert outlet and construction of new guardrail on both sides on NH 107. Supplemental Narrative attached.

5. SHORELINE FRONTAGE:

☒ N/A This does not have shoreline frontage.

SHORELINE FRONTAGE:

Shoreline Frontage is calculated by determining the average of the distances of the actual natural navigable shoreline frontage and a straight line drawn between the property lines, both of which are measured at the normal high water line (Env-Wt 101.89).

6. RELATED NHDES LAND RESOURCES MANAGEMENT PERMIT APPLICATIONS ASSOCIATED WITH THIS PROJECT:

Please indicate if any of the following permit applications are required and, if required, the status of the application.

To determine if other Land Resources Management Permits are required, refer to the Land Resources Management Website.

Permit Type	Permit Required	File Number	Permit Application Status
Alteration of Terrain Permit Per RSA 485-A:17	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	_____	<input type="checkbox"/> APPROVED <input type="checkbox"/> PENDING <input type="checkbox"/> DENIED
Individual Sewerage Disposal per RSA 485-A:2	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	_____	<input type="checkbox"/> APPROVED <input type="checkbox"/> PENDING <input type="checkbox"/> DENIED
Subdivision Approval Per RSA 485-A	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	_____	<input type="checkbox"/> APPROVED <input type="checkbox"/> PENDING <input type="checkbox"/> DENIED
Shoreland Permit Per RSA 483-B	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	_____	<input type="checkbox"/> APPROVED <input type="checkbox"/> PENDING <input type="checkbox"/> DENIED

7. NATURAL HERITAGE BUREAU & DESIGNATED RIVERS:

See the Instructions & Required Attachments document for instructions to complete a & b below.

a. Natural Heritage Bureau File ID: **NHB 19 - 0430**

b. ☐ This project is within a Designated River corridor. The project is within ¼ mile of: _____; and
date a copy of the application was sent to the Local River Management Advisory Committee: Month: ___ Day: ___ Year: ____

☒ N/A - This project is not within a Designated River corridor.

lrn@des.nh.gov or (603) 271-2147

NHDES Wetlands Bureau, 29 Hazen Drive, PO Box 95, Concord, NH 03302-0095

www.des.nh.gov

8. APPLICANT INFORMATION (Desired permit holder)			
LAST NAME, FIRST NAME, M.I.: Kirk Mudgett, PE			
TRUST / COMPANY NAME: NHDOT - Bureau of Highway Design		MAILING ADDRESS: PO Box 483	
TOWN/CITY: Concord		STATE: NH	ZIP CODE: 03302
EMAIL or FAX: Kirk.Mudgett@dot.nh.gov		PHONE: 603-271-1598	
ELECTRONIC COMMUNICATION: By initialing here: _____, I hereby authorize NHDES to communicate all matters relative to this application electronically.			
9. PROPERTY OWNER INFORMATION (If different than applicant)			
LAST NAME, FIRST NAME, M.I.: NH Dept. of Transportation			
TRUST / COMPANY NAME: NH Dept. of Transportation		MAILING ADDRESS: PO Box 483	
TOWN/CITY: Concord		STATE: NH	ZIP CODE: 03302
EMAIL or FAX: Andrew.O'Sullivan@dot.nh.gov		PHONE: 271-3226	
ELECTRONIC COMMUNICATION: By initialing here AO , I hereby authorize NHDES to communicate all matters relative to this application electronically.			
10. AUTHORIZED AGENT INFORMATION			
LAST NAME, FIRST NAME, M.I.:		COMPANY NAME:	
MAILING ADDRESS:			
TOWN/CITY:		STATE:	ZIP CODE:
EMAIL or FAX:		PHONE:	
ELECTRONIC COMMUNICATION: By initialing here _____, I hereby authorize NHDES to communicate all matters relative to this application electronically.			
11. PROPERTY OWNER SIGNATURE:			
See the <u>Instructions & Required Attachments</u> document for clarification of the below statements			
By signing the application, I am certifying that:			
<ol style="list-style-type: none"> 1. I authorize the applicant and/or agent indicated on this form to act in my behalf in the processing of this application, and to furnish upon request, supplemental information in support of this permit application. 2. I have reviewed and submitted information & attachments outlined in the <u>Instructions and Required Attachment</u> document. 3. All abutters have been identified in accordance with RSA 482-A:3, I and Env-Wt 100-900. 4. I have read and provided the required information outlined in Env-Wt 302.04 for the applicable project type. 5. I have read and understand Env-Wt 302.03 and have chosen the least impacting alternative. 6. Any structure that I am proposing to repair/replace was either previously permitted by the Wetlands Bureau or would be considered grandfathered per Env-Wt 101.47. 7. I have submitted a Request for Project Review (RPR) Form (<u>www.nh.gov/nhdhr/review</u>) to the NH State Historic Preservation Officer (SHPO) at the NH Division of Historical Resources to identify the presence of historical/ archeological resources while coordinating with the lead federal agency for National Historic Preservation Act (NHPA) 106 compliance. 8. I authorize NHDES and the municipal conservation commission to inspect the site of the proposed project. 9. I have reviewed the information being submitted and that to the best of my knowledge the information is true and accurate. 10. I understand that the willful submission of falsified or misrepresented information to the NHDES is a criminal act, which may result in legal action. 11. I am aware that the work I am proposing may require additional state, local or federal permits which I am responsible for obtaining. 12. The mailing addresses I have provided are up to date and appropriate for receipt of NHDES correspondence. NHDES will not forward returned 			
		Kirk Mudgett Print name legibly	
Property Owner Signature		Date	

MUNICIPAL SIGNATURES

12. CONSERVATION COMMISSION SIGNATURE

The signature below certifies that the municipal conservation commission has reviewed this application, and:

1. Waives its right to intervene per RSA 482-A:11;
2. Believes that the application and submitted plans accurately represent the proposed project; and
3. Has no objection to permitting the proposed work.



Print name legibly

Date

DIRECTIONS FOR CONSERVATION COMMISSION

1. Expedited review ONLY requires that the conservation commission's signature is obtained in the space above.
2. Expedited review requires the Conservation Commission signature be obtained **prior** to the submittal of the original application to the Town/City Clerk for signature.
3. The Conservation Commission may refuse to sign. If the Conservation Commission does not sign this statement for any reason, the application is not eligible for expedited review and the application will be reviewed in the standard review time frame.

13. TOWN / CITY CLERK SIGNATURE

As required by Chapter 482-A:3 (amended 2014), I hereby certify that the applicant has filed four application forms, four detailed plans, and four USGS location maps with the town/city indicated below.



Print name legibly

Town/City

Date

DIRECTIONS FOR TOWN/CITY CLERK:

Per RSA 482-A:3, I

1. For applications where "Expedited Review" is checked on page 1, if the Conservation Commission signature is not present, NHDES will accept the permit application, but it will NOT receive the expedited review time.
2. IMMEDIATELY sign the original application form and four copies in the signature space provided above;
3. Return the signed original application form and attachments to the applicant so that the applicant may submit the application form and attachments to NHDES by mail or hand delivery.
4. IMMEDIATELY distribute a copy of the application with one complete set of attachments to each of the following bodies: the municipal Conservation Commission, the local governing body (Board of Selectmen or Town/City Council), and the Planning Board; and
5. Retain one copy of the application form and one complete set of attachments and make them reasonably accessible for public review.

DIRECTIONS FOR APPLICANT:

1. Submit the single, original permit application form bearing the signature of the Town/ City Clerk, additional materials, and the application fee to NHDES by mail or hand delivery.

irm@des.nh.gov or (603) 271-2147

NHDES Wetlands Bureau, 29 Hazen Drive, PO Box 95, Concord, NH 03302-0095

www.des.nh.gov

14. IMPACT AREA:

For each jurisdictional area that will be/has been impacted, provide square feet and, if applicable, linear feet of impact.

Permanent: impacts that will remain after the project is complete.

Temporary: impacts not intended to remain (and will be restored to pre-construction conditions) after the project is completed.

Intermittent Streams: linear footage distance of disturbance is measured along the thread of the channel.

Perennial Streams/ Rivers: the total linear footage distance is calculated by summing the lengths of disturbance to the channel and each bank.

JURISDICTIONAL AREA	PERMANENT Sq. Ft. / Lin. Ft.	TEMPORARY Sq. Ft. / Lin. Ft.
Forested wetland	<input type="checkbox"/> ATF	<input type="checkbox"/> ATF
Scrub-shrub wetland	<input type="checkbox"/> ATF	<input type="checkbox"/> ATF
Emergent wetland	15 <input type="checkbox"/> ATF	1207 <input type="checkbox"/> ATF
Wet meadow	<input type="checkbox"/> ATF	<input type="checkbox"/> ATF
Intermittent stream channel	/ <input type="checkbox"/> ATF	/ <input type="checkbox"/> ATF
Perennial Stream / River channel	129 / 15 <input type="checkbox"/> ATF	464 / 71 <input type="checkbox"/> ATF
Lake / Pond	/ <input type="checkbox"/> ATF	/ <input type="checkbox"/> ATF
Bank - Intermittent stream	/ <input type="checkbox"/> ATF	/ <input type="checkbox"/> ATF
Bank - Perennial stream / River	380 / 74 <input type="checkbox"/> ATF	388 / 57 <input type="checkbox"/> ATF
Bank - Lake / Pond	/ <input type="checkbox"/> ATF	/ <input type="checkbox"/> ATF
Tidal water	/ <input type="checkbox"/> ATF	/ <input type="checkbox"/> ATF
Salt marsh	<input type="checkbox"/> ATF	<input type="checkbox"/> ATF
Sand dune	<input type="checkbox"/> ATF	<input type="checkbox"/> ATF
Prime wetland	<input type="checkbox"/> ATF	<input type="checkbox"/> ATF
Prime wetland buffer	<input type="checkbox"/> ATF	<input type="checkbox"/> ATF
Undeveloped Tidal Buffer Zone (TBZ)	<input type="checkbox"/> ATF	<input type="checkbox"/> ATF
Previously-developed upland in TBZ	<input type="checkbox"/> ATF	<input type="checkbox"/> ATF
Docking - Lake / Pond	<input type="checkbox"/> ATF	<input type="checkbox"/> ATF
Docking - River	<input type="checkbox"/> ATF	<input type="checkbox"/> ATF
Docking - Tidal Water	<input type="checkbox"/> ATF	<input type="checkbox"/> ATF
Vernal Pool	<input type="checkbox"/> ATF	<input type="checkbox"/> ATF
TOTAL	524 / 89	2059 / 128

15. APPLICATION FEE: See the Instructions & Required Attachments document for further instruction

☐ Minimum Impact Fee: Flat fee of \$ 200

☒ Minor or Major Impact Fee: Calculate using the below table below

Permanent and Temporary (non-docking) 2583 sq. ft. X \$0.20 = \$ 516.60

Temporary (seasonal) docking structure: sq. ft. X \$1.00 = \$

Permanent docking structure: sq. ft. X \$2.00 = \$

Projects proposing shoreline structures (including docks) add \$200 = \$

Total = \$ 516.60

The Application Fee is the above calculated Total or \$200, whichever is greater = \$ 516.60

irm@des.nh.gov or (603) 271-2147

NHDES Wetlands Bureau, 29 Hazen Drive, PO Box 95, Concord, NH 03302-0095

www.des.nh.gov



The State of New Hampshire
Department of Environmental Services



Robert R. Scott, Commissioner

EMERGENCY AUTHORIZATION VERIFICATION

FILE NUMBER: 2019-02481
OWNER: NH DEPARTMENT OF TRANSPORTATION - DISTRICT 6
SITE LOCATION: NH RTE 107, NORTHWOOD; TAX MAP #ROW, LOT #ROW
AGENT/CONTRACTOR: NH DEPARTMENT OF TRANSPORTATION - DISTRICT 6
WATERBODY:

This is to confirm that the New Hampshire Department of Environmental Services (NHDES) has given emergency authorization in accordance with NH Administrative Rule Env-Wt 500 to the owner/agent to conduct the following work in the NHDES Wetlands Bureau jurisdiction (under RSA 482-A):

DESCRIPTION: Remove existing failed 5 ft. x 7 ft. arch pipe and install a temporary 66 inch x 48 ft. long corrugated steel pipe aluminized.

This authorization is subject to the following conditions:

1. The applicant/contractor shall file a **follow up Standard Wetlands Application for after-the-fact impacts for the work performed under this authorization to NHDES by October 11, 2019 (60 days);**
2. Work shall be conducted in a manner so as to minimize turbidity and sedimentation to surface waters and wetlands;
3. Appropriate siltation, erosion controls, turbidity, and sedimentation controls shall be utilized;
4. Extreme precautions shall be taken within riparian areas to limit unnecessary removal of vegetation for access;
5. Construction equipment shall be inspected daily for leaking fuel, oil, and hydraulic fluid prior to working near surface waters or wetlands;
6. Faulty equipment shall be repaired prior to working near jurisdictional areas;
7. The contractor shall have appropriate oil spill kits on site and readily accessible at all times during construction and each operator shall be trained in its use;
8. This form shall be properly posted at the work site;
9. This authorization does not convey a property right, nor authorize any injury to property of others, nor invasion of rights of others.

THIS AUTHORIZATION EXPIRES ON September 11, 2019 (30 days). All work must be completed by this date. This authorization has been given file number **2019-02481**. Please use this number in all future correspondence.

Date: August 12, 2019

Signed:

Craig D. Rennie, CWS, CWB
Inland Wetland Supervisor

Mary Ann Tilton
Assistant Bureau Administrator
Wetlands Bureau
Land Resources Management

cc: Northwood Municipal Clerk/Conservation Commission
US Army Corps of Engineers



Photo 1: Looking North (upstream) at outlet toward NH 107

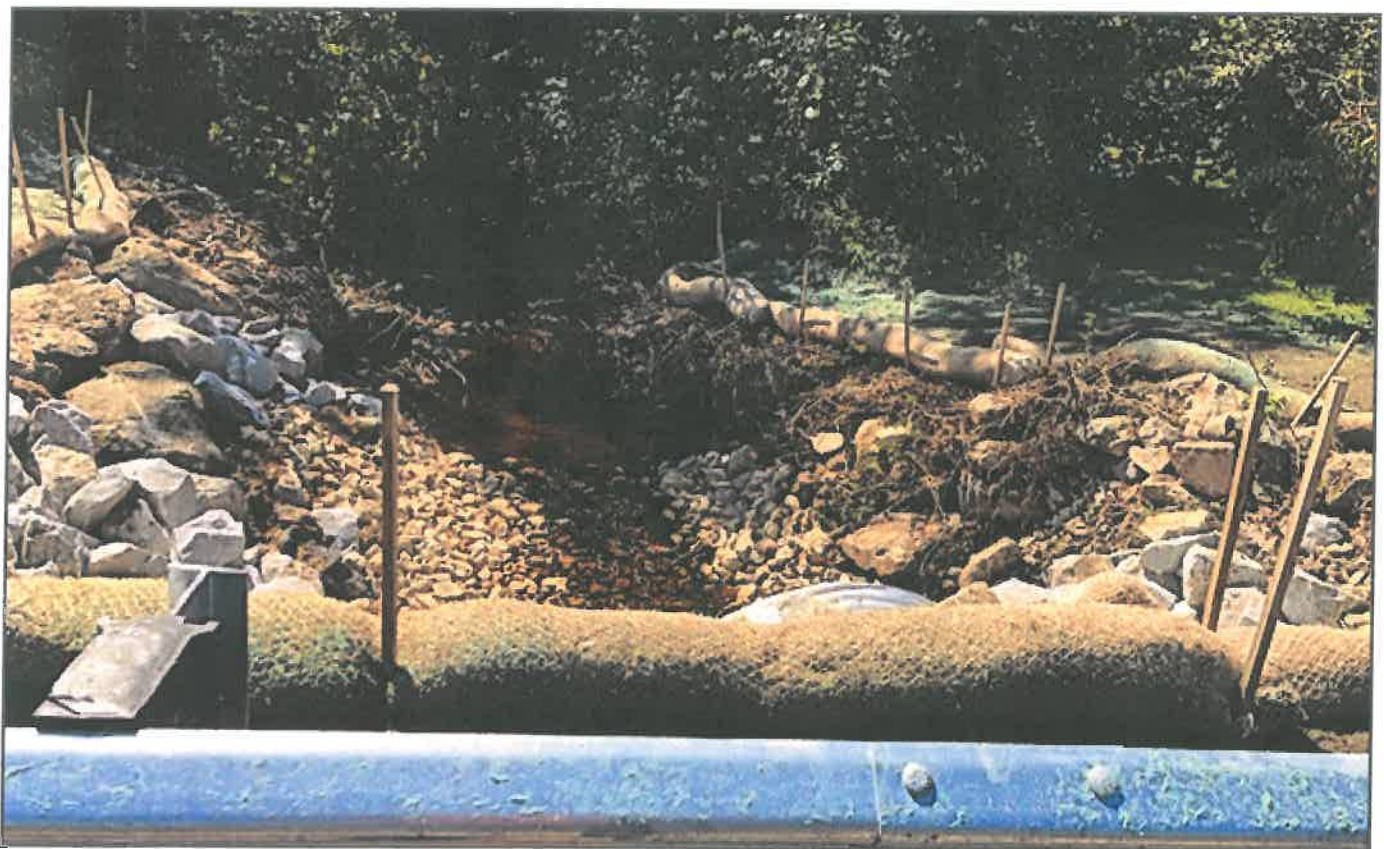


Photo 2: Looking South (downstream) at outlet from NH 107

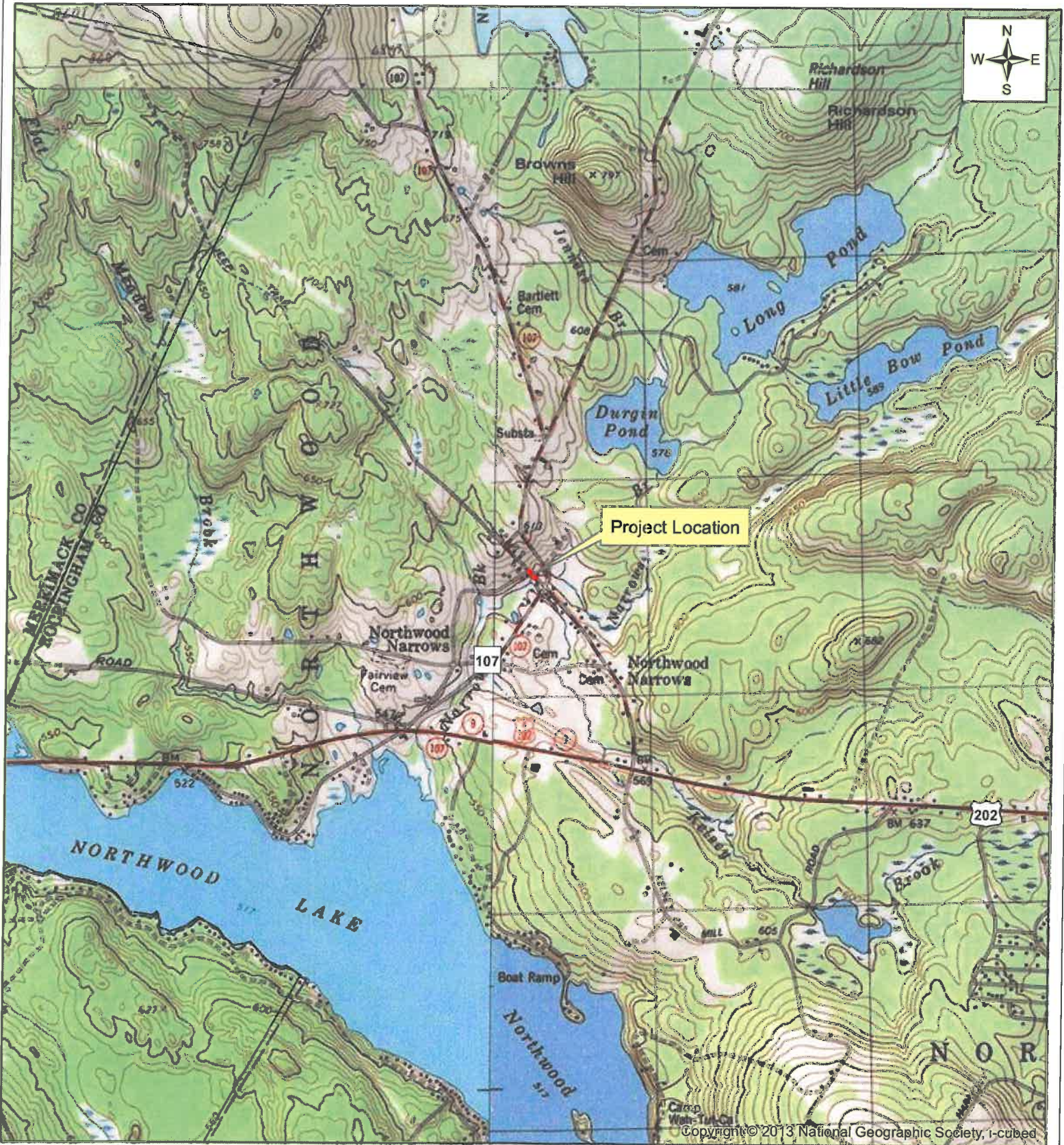


Photo 3: Looking South (downstream) at inlet toward NH 107



Photo 4: Looking North (upstream) at inlet from NH 107

NORTHWOOD, #42363



Copyright © 2013 National Geographic Society, i-cubed

0 0.25 0.5 0.75 Miles

1:24,000

New Hampshire
DOT
Department of Transportation



Legend

- Project Boundary-42363(L)
- Town Boundary

Map depicting project location of Northwood #42363, a culvert replacement which carries NH Route 107 over a un-named tributary to Narrows Brook.

Map created by: Arin Mills on 6/5/2019

Source: S:\Environment\PROJECTS\NORTHWOOD\42363



WETLANDS PERMIT APPLICATION – ATTACHMENT A MINOR AND MAJOR - 20 QUESTIONS

Land Resources Management
Wetlands Bureau

Check the Status of your application: www.des.nh.gov/onestop



RSA/ Rule: RSA 482-A, Env-Wt 100-900

Env-Wt 302.04 Requirements for Application Evaluation - For any major or minor project, the applicant shall demonstrate by plan and example that the following factors have been considered in the project's design in assessing the impact of the proposed project to areas and environments under the department's jurisdiction. Respond with statements demonstrating:

1. The need for the proposed impact.

This project is needed to address the deterioration of a 5' high x 7' wide cmp arch pipe carrying Narrows Brook underneath NH 107. The culvert is severely deteriorated along the bottom and is undersized. Delaying the replacement increases the risk of structural failure and associated impacts such as road closure, sediment discharge into the stream, and disruption of aquatic organism passage, and additional impacts associated with a temporary repair.

A 12" corrugated metal closed drainage pipe (outlet at Sta 102+70, Rt 33') is also severely deteriorated. This pipe outlet is in close proximity to the existing culvert and would be partially disturbed by the culvert replacement.

2. That the alternative proposed by the applicant is the one with the least impact to wetlands or surface waters on site.

The following project alternatives were considered:

Embedded pipe culvert which would have about the same capacity as the existing culvert. This option does not meet 50 year storm hydraulic requirements.

Embedded 5' x 8' (clear opening) box culvert. This option does not meet 100 year storm hydraulic design requirements.

A fully compliant structure based on stream crossing requirements, which would be a 28' span bridge. This option would have significantly larger temporary and permanent wetland impacts, larger impacts to adjacent private property and the travelling public, and a much larger financial commitment which the programed funds can't support.

lrn@des.nh.gov or (603) 271-2147

NHDES Wetlands Bureau, 29 Hazen Drive, PO Box 95, Concord, NH 03302-0095

www.des.nh.gov

3. The type and classification of the wetlands involved.

The wetland resources that will be impacted include Narrows Brook and its adjacent floodplain, R2UB1/2, PEM1E

4. The relationship of the proposed wetlands to be impacted relative to nearby wetlands and surface waters.

The impacts include the bank and channel of Narrows Brook. The camp arch inlet is approximately .8 miles south of the Durgin Pond outlet, and the camp outlet is approximately 92' north of the intersection of Kelsey Brook.

5. The rarity of the wetland, surface water, sand dunes, or tidal buffer zone area.

The wetlands and streams within the project area are typical of the region and are not considered to be rare.

6. The surface area of the wetlands that will be impacted.

Below are the details of the wetland impacts :

Temporary wetland impact = 1,207 SF

Temporary bank impact = 388 SF / 57 LF

Temporary perennial stream impact = 464 SF / 71 LF

Permanent perennial stream impact = 129 SF / 15 LF

Permanent wetland impact = 15 SF

Permanent bank impact = 380 SF / 74 LF

7. The impact on plants, fish and wildlife including, but not limited to:

- a. Rare, special concern species;
- b. State and federally listed threatened and endangered species;
- c. Species at the extremities of their ranges;
- d. Migratory fish and wildlife;
- e. Exemplary natural communities identified by the DRED-NHB; and
- f. Vernal pools.

a. Results of the NH Natural Heritage Bureau database search (NHB19-0430) resulted in a historic record of Spotted turtle within the vicinity of the project area. Coordination with NH Fish & Game found that the proposed 6" embedded culvert with simulated streambed will improve aquatic species passage, and therefore will not negatively impact the Spotted turtle.

b. No additional concerns for impacts to state listed species were identified at the June 19, 2019 Natural Resource Agency Meeting. Results of the USFWS iPaC search identified the Northern Long-eared bat (NLEB) and Small Whorled Pogonia on the Official Species List and having potential to be in the project area. Further review with the USFWS found that the project is consistent with the Programmatic Biological Opinion for the NLEB and the action is not prohibited under the Endangered Species Act 4(d) Rule where tree clearing will occur (>3" dbh). No effects on the Small Whorled Pogonia are expected as the project will not occur in habitat for the species.

c. No species at the extremities of their range are known to occur in the project area.

d. Impacts to migratory fish and wildlife are not anticipated as the proposed work will not alter the flow of water, both velocity or location, within the stream. The stream has not been identified at Essential Fish Habitat.

e. No exemplary natural communities have been identified in the project area by the NH Natural Heritage Bureau (NHB19-0430).

f. No vernal pools occur within the project area.

8. The impact of the proposed project on public commerce, navigation and recreation.

The project will have a temporary impact to public commerce due to delays associated with traffic control. There will be no permanent impact to public commerce.

There will be no impact to navigation since the existing stream is too small to be navigable.

The existing stream does not appear to be used for recreation. Access to the stream (within the work area) will be restricted during construction (about 1 month duration). There will be no permanent impact to potential recreational uses.

Best Management Practices (BMPs) will be used during construction to minimize any downstream water quality impacts.

9. The extent to which a project interferes with the aesthetic interests of the general public. For example, where an applicant proposes the construction of a retaining wall on the bank of a lake, the applicant shall be required to indicate the type of material to be used and the effect of the construction of the wall on the view of other users of the lake.

The proposed culvert replacement will not interfere with the aesthetic interest of the general public. Post construction conditions will be similar to existing conditions and no adverse visual impacts are anticipated.

Some vegetation clearing (total of approximately 800 SF of small trees and brush) will be required for construction access and staging at the culvert inlet and outlet. This will result in temporary visual impact. Existing stones lining the banks will be reset and the cleared areas will be allowed to naturally reestablish.

10. The extent to which a project interferes with or obstructs public rights of passage or access. For example, where the applicant proposes to construct a dock in a narrow channel, the applicant shall be required to document the extent to which the dock would block or interfere with the passage through this area.

The project will have no permanent impact to public rights of passage or access. There will be temporary impacts to traffic and access to areas of the stream within the work area will be restricted.

11. The impact upon abutting owners pursuant to RSA 482-A:11, II. For example, if an applicant is proposing to rip-rap a stream, the applicant shall be required to document the effect of such work on upstream and downstream abutting properties.

The project will not have a significant permanent effect on abutters. The majority of the work is within the existing ROW. Permanent changes to topography do not extend more than 5' past the top of bank in areas of private property. Permanent drainage easements are proposed at the culvert inlet and outlet, and temporary construction easements will be acquired for access to areas outside the ROW. The proposed work will not change off site flow conditions or water levels, other than lowering high flow event water elevations on the inlet side of the culvert. Work areas outside the existing ROW will be restored similar to existing conditions once construction is completed.

12. The benefit of a project to the health, safety, and well being of the general public.

The 5' high x 7' wide cmp arch pipe has a severely deteriorated invert which will eventually result in a structural failure causing potential harm to the general public. The proposed box culvert will allow for safe passage over Narrows Brook and the proposed guardrail will improve safety for the traveling public.

13. The impact of a proposed project on quantity or quality of surface and ground water. For example, where an applicant proposes to fill wetlands the applicant shall be required to document the impact of the proposed fill on the amount of drainage entering the site versus the amount of drainage exiting the site and the difference in the quality of water entering and exiting the site.

The project will not result in any changes in impervious surface or flood storage capacity, so no changes in the quantity or quality of stormwater runoff are anticipated. No changes to existing drainage flow patterns are proposed. The proposed drainage changes (Box Culvert and 15" plastic pipe) will not have an effect on the surface or ground water within the project area.

Temporary impacts to water quality during construction will be minimized through the use of erosion and sedimentation controls.

Stormwater treatment for the closed drainage system outfall was considered, but was determined impractical due to the extent of impacts to the Hartigan property (Sta 102+00 Rt). Treatment for this outfall would consist of a forebay and grass treatment swale, with a combined length of about 120', a 4' - 6' wide swale bottom, 3:1 side slopes, and a top width of about 30'. Due to the proximity of the last catch basin (60' from the outlet) and the existing driveway, the practice would need to be constructed parallel to the top of bank, moving the outfall point approximately 100' downstream. Permanent impacts to the property would include 5,000 SF of permanent drainage easement, removal of ornamental / fruit trees and other vegetation, and removal or relocation of an outbuilding (at stream station 13+35 Rt), as well as additional temporary impacts.

14. The potential of a proposed project to cause or increase flooding, erosion, or sedimentation.

The proposed project will not increase flooding, erosion, or sedimentation. The proposed box culvert will have a significant increase in capacity, lower headwater depths, and lower outlet velocity. Sediment transport capacity will be similar to that of the upstream and downstream channels. See the Alternative Design Technical Report in this application for additional information.

15. The extent to which a project that is located in surface waters reflects or redirects current or wave energy which might cause damage or hazards.

N/A. The streams in the project area are relatively small and the project is not expected to alter current or wave energy.

16. The cumulative impact that would result if all parties owning or abutting a portion of the affected wetland or wetland complex were also permitted alterations to the wetland proportional to the extent of their property rights. For example, an applicant who owns only a portion of a wetland shall document the applicant's percentage of ownership of that wetland and the percentage of that ownership that would be impacted.

Because the project only requires the installation of a 5' high x 9' wide box culvert and installation of a 15' plastic pipe, temporary and permanent impacts are limited to small areas on each end of the culvert, as well as areas for construction staging and access. Cumulative impacts that would result from abutting property owner actions would likely not be substantial if the abutters impacts were also limited to small temporary/permanent impacts for the rehabilitation or replacement of existing structures.

17. The impact of the proposed project on the values and functions of the total wetland or wetland complex.

The replacement of the deteriorated cmp arch pipe and closed drainage pipe will not cause any significant change to the values and functions of the stream and wetland complexes. Constructing a natural bottom through the proposed culvert may improve stream value slightly. Permanent impacts have been kept to a minimum and will not impact the values and functions of the total wetland or wetland complex.

The proposed box culvert will not significantly alter the stream flow or water levels within the stream channels or adjacent wetlands. The wetland complexes will continue to provide functions and values at levels similar to pre-construction conditions.

Temporary disturbance to wildlife and aquatic habitat may occur during construction as a result of clearing vegetation, diverting the stream, and operating construction equipment.

No changes to the wetland complexes' ability to provide sediment retention and stabilization are anticipated, except for the removal of vegetation for the construction access and staging. Wetland vegetation will be allowed to re-establish naturally.

18. The impact upon the value of the sites included in the latest published edition of the National Register of Natural Landmarks, or sites eligible for such publication.

The proposed project will not impact any sites listed on the National Register of Natural Landmarks or sites eligible for listing. A cultural review found the proposed project lies within the Northwood Narrows Historic District, deemed eligible for listing on the National Register of Historic Places in 1994, determined 'No Potential to Cause Effect' due to the minimal impact to the existing structure.

19. The impact upon the value of areas named in acts of congress or presidential proclamations as national rivers, national wilderness areas, national lakeshores, and such areas as may be established under federal, state, or municipal laws for similar and related purposes such as estuarine and marine sanctuaries.

N/A - No such areas are located near the project.

20. The degree to which a project redirects water from one watershed to another.

The project will not make any changes that would redirect water from one watershed to another.

Additional comments

irm@des.nh.gov or (603) 271-2147

NHDES Wetlands Bureau, 29 Hazen Drive, PO Box 95, Concord, NH 03302-0095

www.des.nh.gov

BUREAU OF ENVIRONMENT CONFERENCE REPORT

SUBJECT: NHDOT Monthly Natural Resource Agency Coordination Meeting

DATE OF CONFERENCE: June 19, 2019

LOCATION OF CONFERENCE: John O. Morton Building

ATTENDED BY:

NHDOT

Matt Urban
Sarah Large
Andrew O'Sullivan
Doug Locker
Tim Boodey
Arin Mills
Chris Carucci
Julius Nemeth
Jennifer Reczek
Anthony Weatherbee
Maggie Baldwin
Jason Abdulla
Marc Laurin
Ralph Sanders
Tim Mallette
Jon Evans
Wendy Johnson

Tom Jameson
Chelsea Noyes

ACOE

Mike Hicks

NHDES

Collis Adams
Karl Benedict
Andrew Madison

NHF&G

Carol Henderson

NH NHB

Amy Lamb

LCHIP

Paula Bellemore

NH DNCR

Tracey Boisvert

**Consultants/Public
Participants**

Lee Carbonneau
Thomas Marshall
Sarah Barnum
Chris Fournier
Christine Perron
Burr Phillips
Greg Howard
Jed Merrow

PRESENTATIONS/ PROJECTS REVIEWED THIS MONTH: *(minutes on subsequent pages)*

Postpone finalizing the April 17, 2019 Meeting Minutes	2
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Bedford, #13962-C (X-004(254))	3
Deerfield, #42279	5
Woodstock, #42618	6
Littleton, #40244	6
Colebrook-Columbia, #42313	6
Shelburne, #42426 (X-A004(842))	8
Dummer-Cambridge-Errol, #16304B (X-A004(699))	11
Nashua-Merrimack-Bedford, #13761	15
Conway, #41755	16
Newington-Dover, #11238S (NHS-027-1(037))	19

(When viewing these minutes online, click on a project to zoom to the minutes for that project)

NOTES ON CONFERENCE:**Postpone finalizing the April 17, 2019 Meeting Minutes****Northwood, #42363**

Chris Carucci provided an overview of the project and the location. The project includes replacement of an existing 5' high x 7' wide cmp arch pipe that is 68' long carrying Narrows Brook under NH Route 107. The existing structure has a severely deteriorated invert causing small sink holes. Incidental work will include replacement of a 12" drainage pipe and catch basin and guardrail replacement. The stream banks are armored with rounded stone, and channel appears stable. The NHDOT Maintenance District indicated this crossing has only flooded in the Mother's Day 2005 flood event.

Streamstats drainage area is 5.35 sq mi (3,424 AC). LIDAR (2011) gives drainage area of 5.42 sq mi (3,470 AC). The percentage of wetlands in the drainage area is outside the Streamstats study range, so flow results were not used. The LIDAR drainage area of 3,470 AC will be used for design, making the crossing a Tier 3.

There are 4 large ponds within the watershed with two having dam controlled outlets (Jenness & Durgin). Hydrocadd was used to model outlet structures and storage, and the model was calibrated using estimated rainfall and overtopping depths from the Mother Day and Patriots Day floods, as reported by the adjacent (garage) property owner. SCS Method (Hydrocadd) predicts Q50 256 cfs and Q100 335 cfs. Design Flows are set at Q50 = 250 cfs and Q100 = 340cfs. Existing hydraulic capacity is about 212 cfs, just prior to overtopping NH 107. A twin 42" rcp culvert just upstream under High St (Town owned) was determined to have only a capacity of about 115 cfs at overtopping.

Arin Mills provided the results of the 2011 stream assessment, which determined a 28' span bridge to be a fully compliant structure. The 100 year FEMA flood zone (Zone A) extends to the culvert outlet. The NHB resulted in a historic record of Spotted turtle. Fish & Game recommended wildlife friendly erosion control netting, no use of riprap on stream bottom and no use of bed retention sills and Arin confirmed all these conditions could be adhered to. Carol Henderson said as long as there were no sills included there were no concern for impacts to the species and no restriction on the depth of culvert embedment.

The cost for a compliant structure (28' span bridge) is estimated at \$1.5 million. A structure of this size would be transferred to the Bureau of Bridge Design resulting in at least 1 year delay. Construction would require road closure for about 3 months. Detour via State Routes would be up to 9.4 miles to Concord and up to 25 miles to get to points east.

Chris described the preferred alternative as a 5' high x 9' wide x 44' long box culvert embedded with 24" of stream simulation, with no change to the existing alignment or profile. The project will also shorten the culvert by about 12' on each side, while the channel will be widened to a minimum width of 9' and the banks will be relined using existing stones. Water diversion will be a temporary bypass pipe with work estimated to take 3-4 weeks while the road remains open to alternating one-lane traffic. The impacts area anticipated to be 360 sf/ 70 lf of permanent impacts and 3,500 sf/ 180 lf of temporary impacts.

Chris indicated that the new culvert will pass the Q50 with no headwater over the crown of the box and no encroachment on NH 107 or the adjacent garage at Q100. The proposed culvert can also accommodate future upsizing of the Town's High St culvert.

Karl Benedict asked for clarification that the Q100 showed an increase in capacity and Chris Carucci confirmed that the proposed culvert will pass the Q100 with headwater elevation just below the adjacent garage elevation.

Matt Urban clarified that since the new culvert will be shorter and there is existing riprap the project would be considered self-mitigating. Matt Urban clarified that since the new culvert will be shorter and there is existing riprap the project may be considered self-mitigating.

Karl Benedict noted additional discussion about addressing stormwater treatment and the limited areas to provide treatment. My additional notes on this one were that abutter permissions would be required and provision of a stream diversion plan.

Karl Benedict asked if there was a specification sheet for the streambed material. Chris said the material would be a mixture of material designed to match the existing stream bed material, along with a placement specification. Collis Adams asked if an open bottom culvert was considered. Chris Carucci said this was not evaluated as a possible alternative for concerns for potential scour at the footing which could lead to deeper embedment.

Mike Hicks asked about the IPaC and 4(d) rule, Arin said both were done, and Northern long eared bat was the only species resulting from the USFWS species list. Mike also asked about floodplain impacts and Arin stated there were no anticipated impacts. Chris determined the hydraulic model shows no change in flow rate or depth in the channel immediately downstream of the culvert.

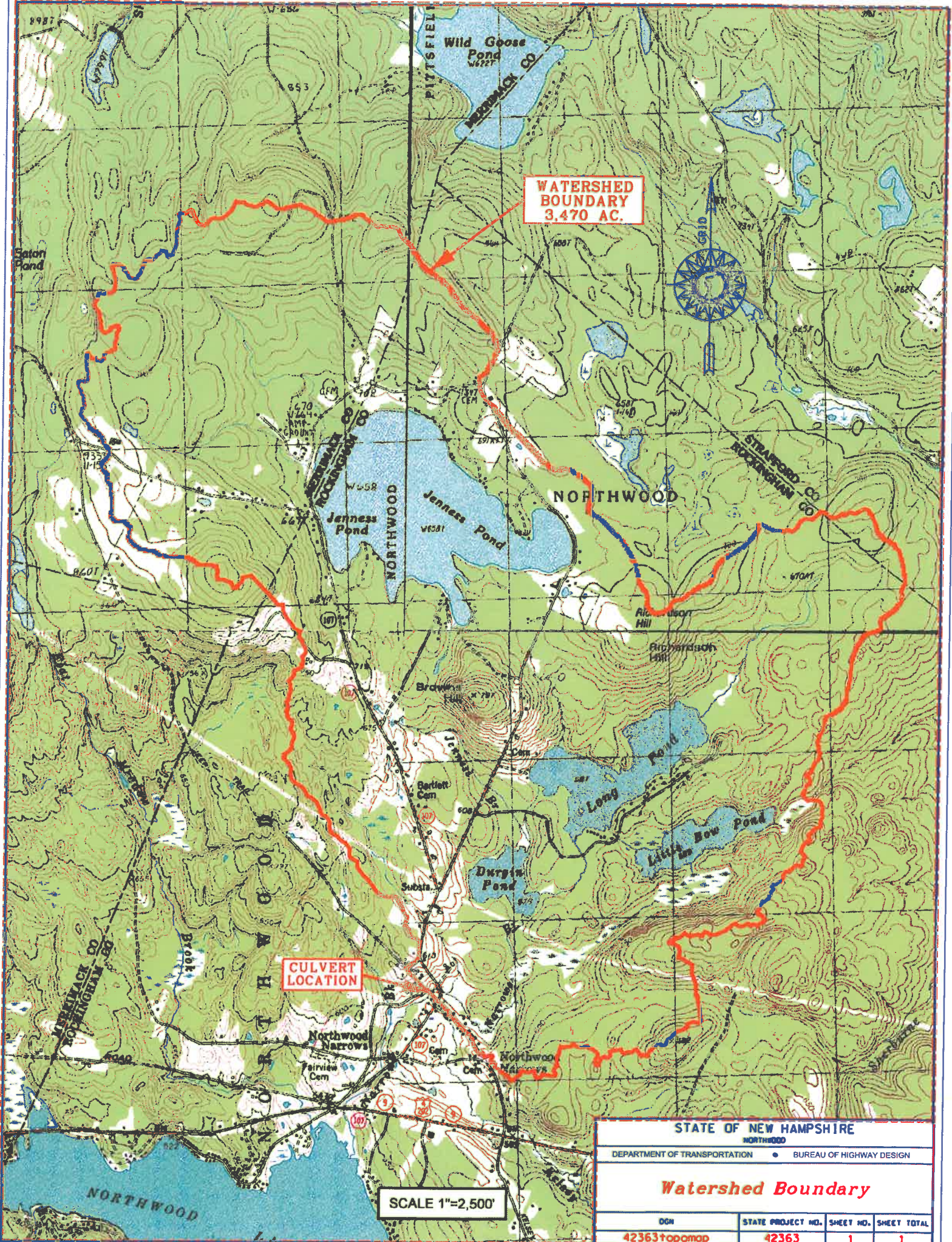
Collis Adams asked if treatment from the 12" cmp outlet was considered. Chris Carucci said that was not considered due to space constraints within the project area. The catch basin and associated pipe are within the private land and treatment would require work in the front lawn. Chris Carucci said catch basins typically have a sump which provides sediment retention and that treatment options would be further investigated.

This project has not been previously discussed at a Monthly Natural Resource Agency Coordination Meeting.

Bedford, #13962-C (X-004(254))

Thom Marshall described the existing bridge and changes to the replacement design since the Project was presented in this venue in September of 2017. The two five-foot diameter culverts will be replaced by a 48-ft clear span precast box-beam bridge. Stormwater treatment swales have been added, and a left turning lane into Twin Brook Road was added based on input at the public meeting. The bankfull channel is 22' wide. A 4-ft 8-inch wide wildlife corridor will be constructed adjacent to each side of the stream channel below the riprap. A temporary bypass will be constructed as close to the south side of the existing road as possible, and construction work on the bridge will be phased.

L. Carbonneau reviewed natural resources. The Aquatic Restoration Mapper shows a flood hazard flag and notes that the existing culvert is undersized, has reduced passage and is in poor condition. Pulpit Brook is a Tier 3 stream with a 5.3 square mile watershed. There is a 100-year floodplain and floodway, but a hydraulic analysis shows that the new crossing decreases flood levels significantly upstream and results in no changes downstream. Fill will be removed around the



WATERSHED
BOUNDARY
3,470 AC.

CULVERT
LOCATION

SCALE 1"=2,500'

STATE OF NEW HAMPSHIRE			
NORTHWOOD			
DEPARTMENT OF TRANSPORTATION		BUREAU OF HIGHWAY DESIGN	
<i>Watershed Boundary</i>			
DCN	STATE PROJECT NO.	SHEET NO.	SHEET TOTAL
42363topomap	42363	1	1

CULVERT REHABILITATION
NH Route 107
NORTHWOOD, NH
NHDOT PROJECT NO. 42363
SUPPLEMENTAL NARRATIVE

Project Description

The project involves the replacement of a 5' high x 7' wide corrugated metal (cmp) arch pipe carrying Narrows Brook under NH 107 about 230' northwest of the High Street / School St intersection. The culvert crosses NH 107 at Sta 102+71.

The project will also include replacement of a 12" cmp closed drainage pipe that outlets in close proximity to the 5x7 culvert outlet (NH 107 Sta 102+70, Rt 33') and construction of new guardrail on both side of NH 107 in the vicinity of the culvert. NH 107 pavement that is disturbed by construction will be replaced in-kind (approximately 24' wide x 6" thick). No new impervious surfaces are proposed. Roadway embankment slopes will be flattened slightly in the vicinity of the new guardrail.

Existing Conditions

NH 107 is classified as a Tier 3 roadway (Regional Corridor), with average annual daily traffic of 1,945 vehicles (2018). It connects US 4 in Northwood to NH 28 in Pittsfield, serving a significant (mostly residential) population.

The crossing is a Tier 3 based on a drainage area of 3,470 acres (5.42 sq miles). Kelsey Brook joins Narrows Brook approximately 92' downstream from the culvert outlet. A Town owned twin 48" concrete culvert crossing is approximately 160' upstream (under High Street). The twin 48" rcp crossing has been identified as a chronic flooding location. The next structure downstream is a bridge/culvert under Ye Olde Canterbury Road, approximately 2,200' downstream from the 5x7 culvert outlet (this crossing was not studied).

No old plans were found and the age of existing 5x7 culvert is unknown. The culvert is 68' long and has a severely deteriorated invert and is undersized. The inlet and outlet sides have mitered ends. The total length of the culvert, including the mitered ends is 68'. The culvert and upstream channel are at near zero slope. The downstream channel is at approximately 2% slope. There is existing stone protection around the mitered ends and along the banks on both sides of the upstream and downstream channels. Upstream channel width varies from about 7' at the culvert inlet to 15' near the twin 48" culvert outlet. The downstream channel width varies from about 7' at the culvert outlet to about 20' at the confluence with Kelsey Brook.

The upstream north side of the channel is undeveloped, predominantly grass and wetland plants with some woody shrubs and small trees. Slopes are gentle, similar to a natural floodplain. Bank is nearly vertical, height 1'-2'. The upstream south side is a commercial property with a 1 story metal garage and chain link fence around most of the perimeter. Channel bank is steep (1:1 average slope, 3'-5' height) and lined with small trees and brush. The outlet north side is a residential property with lawn and fruit trees adjacent to the top of bank. Channel bank is steep (1:1 average slope, 3'-5' height) and lined with woody shrubs. The outlet south side is a potentially historic property with a 2 ½ story building and gravel parking lot adjacent to the stream bank. Channel bank is steep (1:1 average slope, 3'-5' height) and lined with woody shrubs, and some small – medium hardwoods.

NHDOT Bureau of Environment completed a stream assessment, included elsewhere in the application. NHDOT Bureau of Highway Design field reviewed the site in December 2018, May 2019, and July 2019. No evidence of significant erosion or sedimentation was found. Sand, small gravel, and a few cobbles were observed inside the culvert, indicating sediment transport. Baseflow in the inlet side of the culvert (7/17/19) was about 5' wide x 5" deep, flowing about 1.5 ft/s, indicating a flowrate just under 2 cfs. Structural condition of the culvert is poor, with heavy rust and significant perforations along the lower sides. The invert has mostly separated from the sides and is completely missing in some spots.

NHDOT Highway Maintenance District 4 indicated this crossing has only overtopped NH 107 in the Mother's Day 2006 storm, and that small sinkholes in the pavement and/or shoulders have occurred in recent years. The latest occurrence was 7/31/2019.

Hydrology / Hydraulics

USGS Streamstats estimated the drainage area at 5.35 sq mi (3,424 acres). LIDAR data from UNH GRANIT was used to generate contours and check the drainage boundary. Minor differences in watershed boundary were found, resulting in a revised drainage area of 5.42 sq mi, (3,470 acres). The majority of the watershed is mixed forest, residential, and agricultural.

Streamstats runoff prediction for the 5.35 sq mi area was $Q_{50} = 329$ cfs and $Q_{100} = 396$ cf. The % wetlands for this drainage area is outside study range, so results were not used.

There are 4 large ponds within the watershed with two having dam controlled outlets (Jenness & Durgin). Hydrocadd was used to model outlet structures and storage, and the model was calibrated using estimated rainfall and flood depth from the Mother Day (May 2006) flood. Discussion with the adjacent (metal garage) property owner indicated that flood depth in the May 2006 event was over a foot higher than his building floor elevation, and that his property flooded in the Patriot's Day flood (April 2007) flood and in 2003 and 2004.

SCS Method (Hydrocadd) predicts $Q_{50} = 251$ cfs and $Q_{100} = 335$ cfs. Design Flows were set at $Q_{50} = 250$ cfs and $Q_{100} = 340$ cfs

FHWA's HY-8 Culvert Analysis Program was used to evaluate hydraulics for the NH 107 and High Street culverts. The Hydrocadd model was used to evaluate flood routing through the watershed and between the High Street and NH 107 culverts. Hydrocadd's hydraulic modeling of these culverts compared favorably with the HY-8 results. The Hydrocadd model was also used to evaluate the effect of potential future upsizing of the High St culvert to a 5' x 9' box culvert.

The existing hydraulic capacity of the 5x7 culvert is about 212 cfs, just prior to overtopping NH 107. Excess flow will overtop NH 107 in a localized area (Sta 103+00 to Sta 103+50) and flow southwest into the VFW parking lot and back into the downstream channel.

The culvert crossing under High St is a twin 48" rcp, 27' long, 0.37% slope, with capacity of about 135 cfs at just prior to overtopping **(the size and capacity of this crossing were incorrectly reported at the Natural Resource Meeting as twin 42" rcp's, capacity 115 cfs)**. This culvert is identified as a flood hazard location in the NHDES Aquatic Restoration Mapper. Flows that overtop High Street will flow around the south side of the garage and return to the 5x7 culvert inlet.

Proposed Design

The proposed replacement structure is a 5' high x 9' wide (clear opening) box culvert, embedded 6" with stream simulation. **The original design presented at the Natural Resources Meeting was a typical 24" deep embedment.** Subsequent to that meeting, soil borings found shallow bedrock, making the typical 24" embedment impractical. Note that bedrock surfaces can be highly variable, so a 1 foot separation from the highest observed bedrock elevation was used. Removal of significant amounts bedrock would likely require blasting which could adversely impact the adjacent historic property adjacent to the outlet (VFW Hall). The change from 24" embedment to 6" embedment has no effect on hydraulic capacity calculations.

The new culvert alignment and profile will closely match the existing culvert. The proposed culvert length is 44', about 12' shorter than the existing culvert on both ends. The 44' length was selected to accommodate two 12' travel lanes, potential future 4' shoulders, and standard guardrail. The channel will be extended on both sides to match the new culvert ends. New sections of channel will closely match the profile of the existing channel, with a minimum bed width of 9'. Transitions to match the existing channel will occur over a short distance. Proposed match points are 22' downstream and 14' upstream of the new culvert ends. Simulated streambed material will be placed in the new and reconstructed segments of channel bed at a nominal thickness of 24". Existing stone bank protection will be reset along the banks.

In accordance with recommendations from NH Fish & Game, no riprap will be placed in the channel, no bed retention sills or baffles will be used, and wildlife friendly erosion control matting will be used.

The proposed culvert will pass Q50 without submerging the culvert inlet (Q50 headwater El 550.64 vs crown of box El 550.8). The proposed culvert will pass Q100 without encroaching on NH 107 pavement or causing damage to private property. (Q100 headwater El 551.67 vs adjacent (garage) building sill El 551.8 and lowest NH 107 edge of pavement El 552.5).

There will be no significant effect on downstream hydrology or hydraulics from conveying high flows through the new culvert instead of over the road. Flood storage volume and time delay for the overtopping path are very small compared to the total flood volume and duration. Hydrocadd results for potential upsizing of the High St crossing show similarly minimal effects. Upsizing the High St crossing to a 5' x 9' box culvert shows a Q100 headwater increase of only 0.06' at the NH 106 culvert inlet.

FHWA's HY-8 Culvert Analysis Program was used for stream simulation design. The program evaluates water depths, velocities, and channel stability at upstream and downstream of the crossing and compares the results to depths, velocities, and bed stability within the culvert. Stream cross sections used were at 25', 90', and 150' upstream and 25', 46', and 68' downstream of the proposed culvert ends. Pebble counts from the 2011 stream assessment and FHWA's Digital Photo Gradation Analysis tool were used to determine existing streambed substrate gradation and a representative design gradation for the simulated streambed material.

Note that the stream simulation input depth was 24", which is the minimum allowed by the Program. Changing to 6" embedment within the culvert does not change hydraulic calculations for depth, velocity, or erosive force.

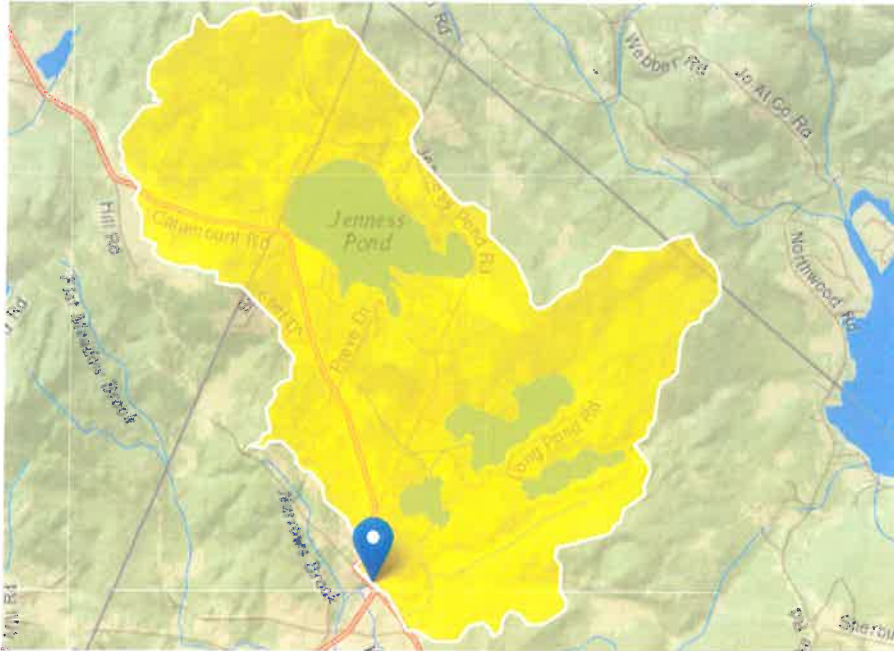
StreamStats Report

Region ID: NH

Workspace ID: NH20190320152124418000

Clicked Point (Latitude, Longitude): 43.22980, -71.24724

Time: 2019-03-20 11:21:38 -0400



Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	5.35	square miles
TEMP	Mean Annual Temperature	44.92	degrees F
PREG_06_10	Mean precipitation at gaging station location for June to October summer period	18.5	inches
APRAVPRE	Mean April Precipitation	3.965	inches
BSLDEM30M	Mean basin slope computed from 30 m DEM	6.064	percent
CENTROIDX	Basin centroid horizontal (x) location in state plane coordinates	1096943.1	feet
CENTROIDY	Basin centroid vertical (y) location in state plane units	273638.1	feet
CONIF	Percentage of land surface covered by coniferous forest	13.8333	percent
CSL10_85	Change in elevation divided by length between points 10 and 85 percent of distance along main channel to basin divide - main channel method not known	61.7	feet per mi

Parameter Code	Parameter Description	Value	Unit
ELEVMAX	Maximum basin elevation	1019.036	feet
LC11DEV	Percentage of developed (urban) land from NLCD 2011 classes 21-24	4.83	percent
LC11IMP	Average percentage of impervious area determined from NLCD 2011 impervious dataset	0.6	percent
MINTEMP_W	Mean winter minimum air temperature over basin surface area	14.131	degrees F
MIXFOR	Percentage of land area covered by mixed deciduous and coniferous forest	32.8203	percent
OUTLETX	Basin outlet horizontal (x) location in state plane coordinates	1096035	feet
OUTLETY	Basin outlet vertical (y) location in state plane coordinates	266265	feet
PREBC0103	Mean annual precipitation of basin centroid for January 1 to March 15 winter period	8.15	inches
PREBC_1112	Mean annual precipitation of basin centroid for November 1 to December 31 period	9.09	inches
PRECIPCENT	Mean Annual Precip at Basin Centroid	45.8	inches
PRECIPOUT	Mean annual precip at the stream outlet (based on annual PRISM precip data in inches from 1971-2000)	45.2	inches
PREG_03_05	Mean precipitation at gaging station location for March 16 to May 31 spring period	9.6	inches
SNOFALL	Mean Annual Snowfall	79.714	inches
TEMP_06_10	Basinwide average temperature for June to October summer period	61.049	degrees F
WETLAND	Percentage of Wetlands	16.766	percent

Low-Flow Statistics Parameters [Low Flow Statewide]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	5.35	square miles	3.26	689
TEMP	Mean Annual Temperature	44.92	degrees F	36	48.7
PREG_06_10	Jun to Oct Gage Precipitation	18.5	inches	16.5	23.1

Low-Flow Statistics Flow Report [Low Flow Statewide]

Pll: Prediction Interval-Lower, Plu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	Pll	Plu	SE	SEp
7 Day 2 Year Low Flow	0.319	ft^3/s	0.117	0.664	55.7	55.7
7 Day 10 Year Low Flow	0.114	ft^3/s	0.0273	0.293	79.4	79.4

Low-Flow Statistics Citations

Flynn, R.H. and Tasker, G.D.,2002, Development of Regression Equations to Estimate Flow Durations and Low-Flow-Frequency Statistics in New Hampshire Streams: U.S.Geological Survey Scientific Investigations Report 02-4298, 66 p. (<http://pubs.water.usgs.gov/wrir02-4298>)

Seasonal Flow Statistics Parameters [Low Flow Statewide]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	5.35	square miles	3.26	689
CONIF	Percent Coniferous Forest	13.8333	percent	3.07	56.2
PREBC0103	Jan to Mar Basin Centroid Precip	8.15	inches	5.79	15.1
BSLDEM30M	Mean Basin Slope from 30m DEM	6.064	percent	3.19	38.1
MIXFOR	Percent Mixed Forest	32.8203	percent	6.21	46.1
PREG_03_05	Mar to May Gage Precipitation	9.6	inches	6.83	11.5
TEMP	Mean Annual Temperature	44.92	degrees F	36	48.7
TEMP_06_10	Jun to Oct Mean Basinwide Temp	61.049	degrees F	52.9	64.4
PREG_06_10	Jun to Oct Gage Precipitation	18.5	inches	16.5	23.1
ELEVMAX	Maximum Basin Elevation	1019.036	feet	260	6290

Seasonal Flow Statistics Flow Report [Low Flow Statewide]

Pll: Prediction Interval-Lower, Plu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	Pll	Plu	SE	SEp
Jan to Mar15 60 Percent Flow	4.18	ft^3/s	2.89	5.82	21.2	21.2
Jan to Mar15 70 Percent Flow	3.55	ft^3/s	2.48	4.89	20.7	20.7
Jan to Mar15 80 Percent Flow	2.98	ft^3/s	2.18	3.98	18.2	18.2
Jan to Mar15 90 Percent Flow	2.21	ft^3/s	1.58	2.99	19.3	19.3
Jan to Mar15 95 Percent Flow	1.74	ft^3/s	1.21	2.4	20.7	20.7
Jan to Mar15 98 Percent Flow	1.37	ft^3/s	0.853	2.07	27.1	27.1
Jan to Mar15 7 Day 2 Year Low Flow	2.89	ft^3/s	2.14	3.8	17.2	17.2
Jan to Mar15 7 Day 10 Year Low Flow	1.61	ft^3/s	1.1	2.25	21.5	21.5
Mar16 to May 60 Percent Flow	9.66	ft^3/s	7.76	11.9	12.2	12.2
Mar16 to May 70 Percent Flow	7.74	ft^3/s	6.33	9.35	11.4	11.4
Mar16 to May 80 Percent Flow	5.97	ft^3/s	4.79	7.35	12.4	12.4
Mar16 to May 90 Percent Flow	4.41	ft^3/s	3.45	5.54	13.7	13.7
Mar16 to May 95 Percent Flow	3.34	ft^3/s	2.57	4.27	14.8	14.8
Mar16 to May 98 Percent Flow	2.33	ft^3/s	1.69	3.14	18.1	18.1
Mar16 to May 7 Day 2 Year Low Flow	4	ft^3/s	3.1	5.06	14.5	14.5

Statistic	Value	Unit	PII	Plu	SE	SEp
Mar16 to May 7 Day 10 Year Low Flow	2.22	ft^3/s	1.66	2.88	16.2	16.2
Jun to Oct 60 Percent Flow	0.885	ft^3/s	0.467	1.52	36.7	36.7
Jun to Oct 70 Percent Flow	0.636	ft^3/s	0.317	1.13	39.9	39.9
Jun to Oct 80 Percent Flow	0.443	ft^3/s	0.203	0.837	44.5	44.5
Jun to Oct 90 Percent Flow	0.27	ft^3/s	0.111	0.546	50.7	50.7
Jun to Oct 95 Percent Flow	0.185	ft^3/s	0.0678	0.398	57	57
Jun to Oct 98 Percent Flow	0.142	ft^3/s	0.0486	0.321	61.1	61.1
Jun to Oct 7 Day 2 Year Low Flow	0.314	ft^3/s	0.114	0.659	55.6	55.6
Jun to Oct 7 Day 10 Year Low Flow	0.113	ft^3/s	0.0276	0.285	78.5	78.5
Nov to Dec 60 Percent Flow	4.54	ft^3/s	3.02	6.53	23.3	23.3
Nov to Dec 70 Percent Flow	3.41	ft^3/s	2.16	5.07	25.9	25.9
Nov to Dec 80 Percent Flow	2.5	ft^3/s	1.53	3.81	27.8	27.8
Nov to Dec 90 Percent Flow	1.59	ft^3/s	0.91	2.55	31.6	31.6
Nov to Dec 95 Percent Flow	1.04	ft^3/s	0.525	1.81	38.3	38.3
Nov to Dec 98 Percent Flow	0.636	ft^3/s	0.258	1.27	50.6	50.6
Oct to Nov 7 Day 2 Year Low Flow	2.46	ft^3/s	1.61	3.55	23.3	23.3
Oct to Nov 7 Day 10 Year Low Flow	0.945	ft^3/s	0.483	1.63	36.6	36.6

Seasonal Flow Statistics Citations

Flynn, R.H. and Tasker, G.D.,2002, Development of Regression Equations to Estimate Flow Durations and Low-Flow-Frequency Statistics in New Hampshire Streams: U.S.Geological Survey Scientific Investigations Report 02-4298, 66 p. (<http://pubs.water.usgs.gov/wrir02-4298>)

Flow-Duration Statistics Parameters [Low Flow Statewide]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	5.35	square miles	3.26	689
PREG_06_10	Jun to Oct Gage Precipitation	18.5	inches	16.5	23.1
TEMP	Mean Annual Temperature	44.92	degrees F	36	48.7

Flow-Duration Statistics Flow Report [Low Flow Statewide]

PII: Prediction Interval-Lower, Plu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	PII	Plu	SE	SEp
60 Percent Duration	3.08	ft^3/s	2.25	4.09	18	18
70 Percent Duration	2	ft^3/s	1.4	2.76	20.6	20.6
80 Percent Duration	1.13	ft^3/s	0.694	1.74	28	28

Statistic	Value	Unit	PII	Plu	SE	SEp
90 Percent Duration	0.552	ft ³ /s	0.285	0.959	37.5	37.5
95 Percent Duration	0.329	ft ³ /s	0.151	0.618	44.1	44.1
98 Percent Duration	0.202	ft ³ /s	0.0774	0.424	54.3	54.3

Flow-Duration Statistics Citations

Flynn, R.H. and Tasker, G.D.,2002, Development of Regression Equations to Estimate Flow Durations and Low-Flow-Frequency Statistics in New Hampshire Streams: U.S.Geological Survey Scientific Investigations Report 02-4298, 66 p. (<http://pubs.water.usgs.gov/wrir02-4298>)

Peak-Flow Statistics Parameters [Peak Flow Statewide SIR2008 5206]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	5.35	square miles	0.7	1290
APRAVPRE	Mean April Precipitation	3.965	inches	2.79	6.23
WETLAND	Percent Wetlands	16.766	percent	0	21.8
CSL10_85	Stream Slope 10 and 85 Method	61.7	feet per mi	5.43	543

Peak-Flow Statistics Flow Report [Peak Flow Statewide SIR2008 5206]

PII: Prediction Interval-Lower, Plu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	PII	Plu	SEp	Equiv. Yrs.
2 Year Peak Flood	92.5	ft ³ /s	56	153	30.1	3.2
5 Year Peak Flood	154	ft ³ /s	91.9	258	31.1	4.7
10 Year Peak Flood	205	ft ³ /s	120	351	32.3	6.2
25 Year Peak Flood	273	ft ³ /s	154	484	34.3	8
50 Year Peak Flood	329	ft ³ /s	180	602	36.4	9
100 Year Peak Flood	396	ft ³ /s	209	751	38.6	9.8
500 Year Peak Flood	557	ft ³ /s	270	1150	44.1	11

Peak-Flow Statistics Citations

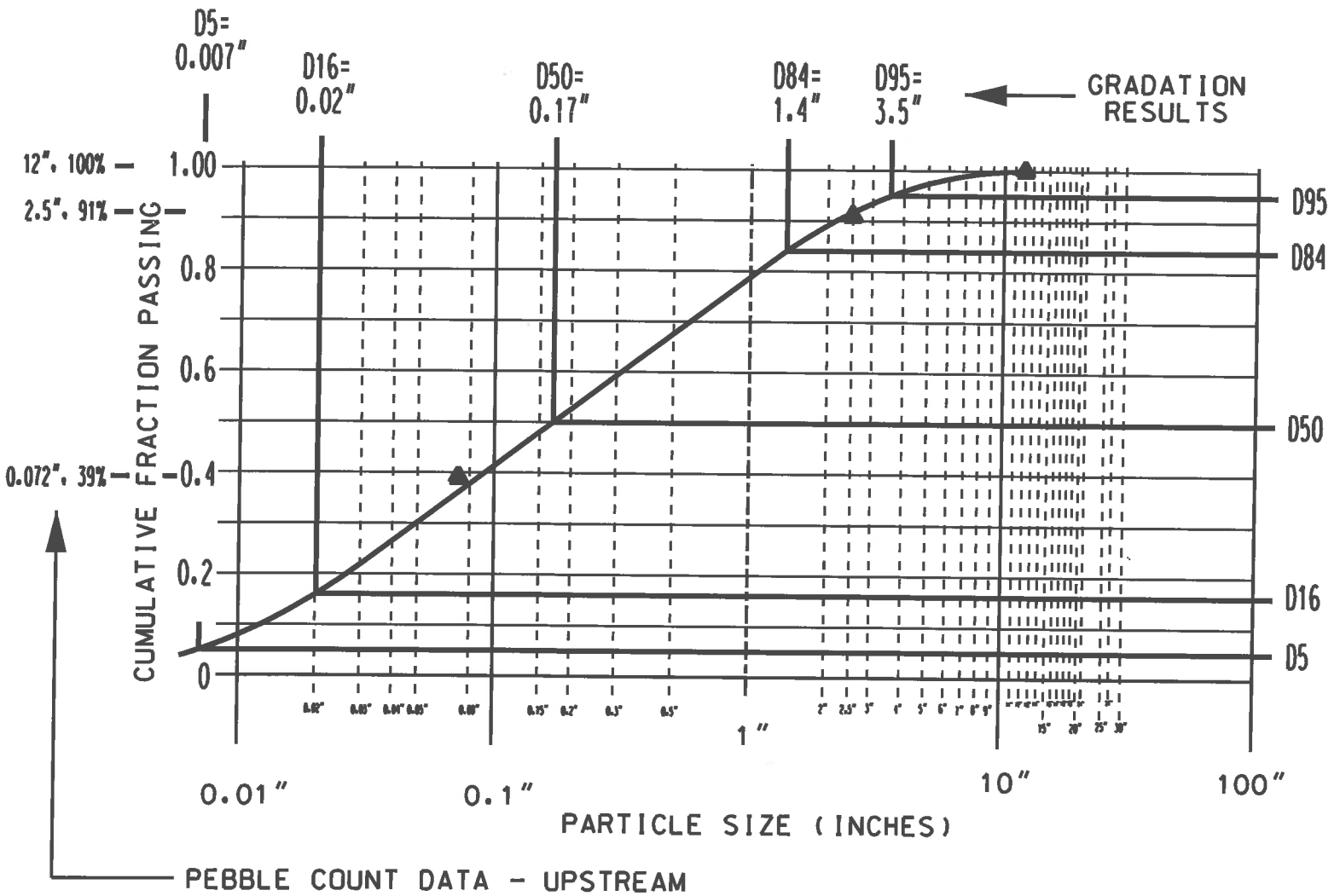
Olson, S.A.,2009, Estimation of flood discharges at selected recurrence intervals for streams in New Hampshire: U.S.Geological Survey Scientific Investigations Report 2008-5206, 57 p. (<http://pubs.usgs.gov/sir/2008/5206/>)

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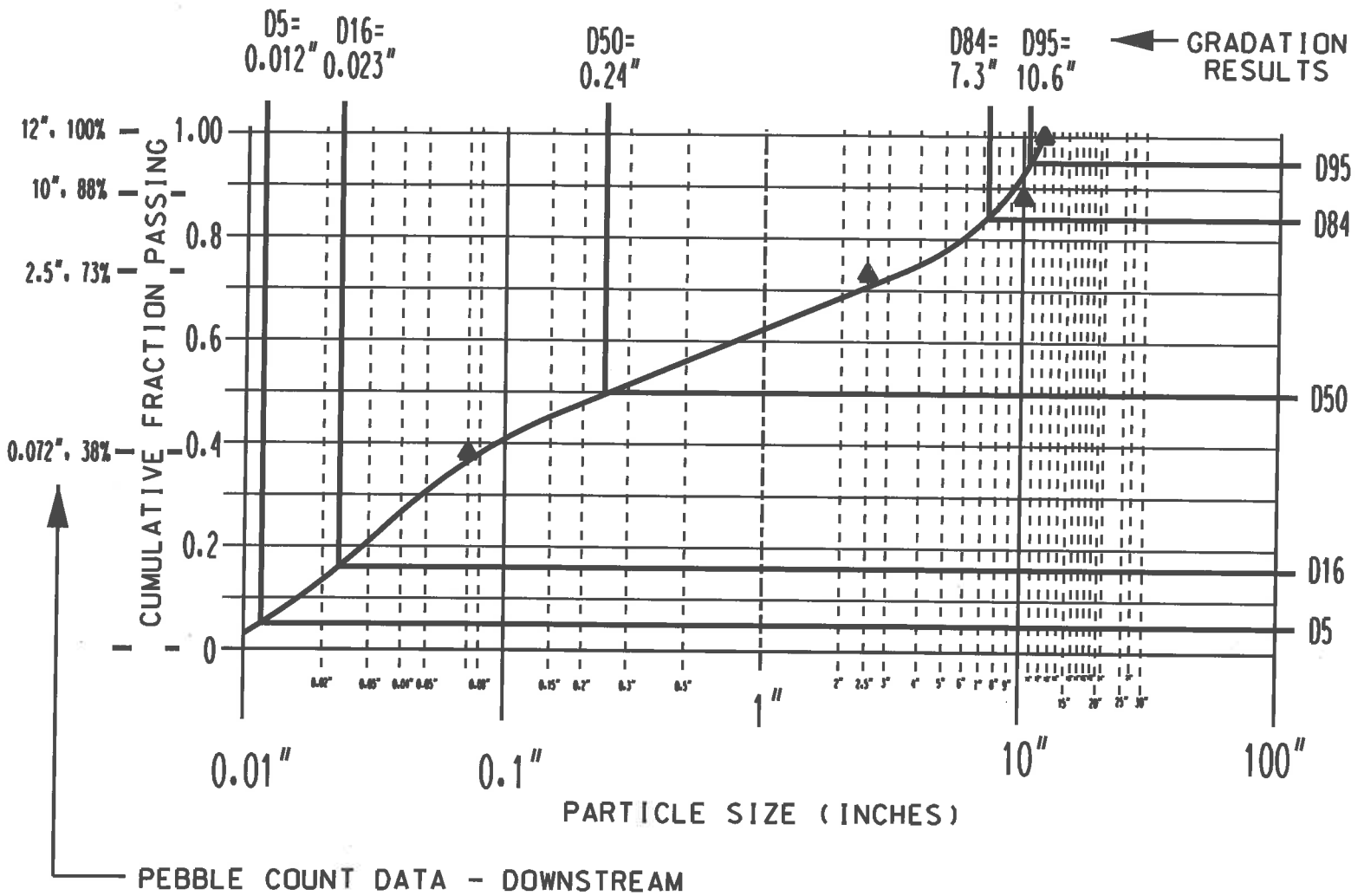
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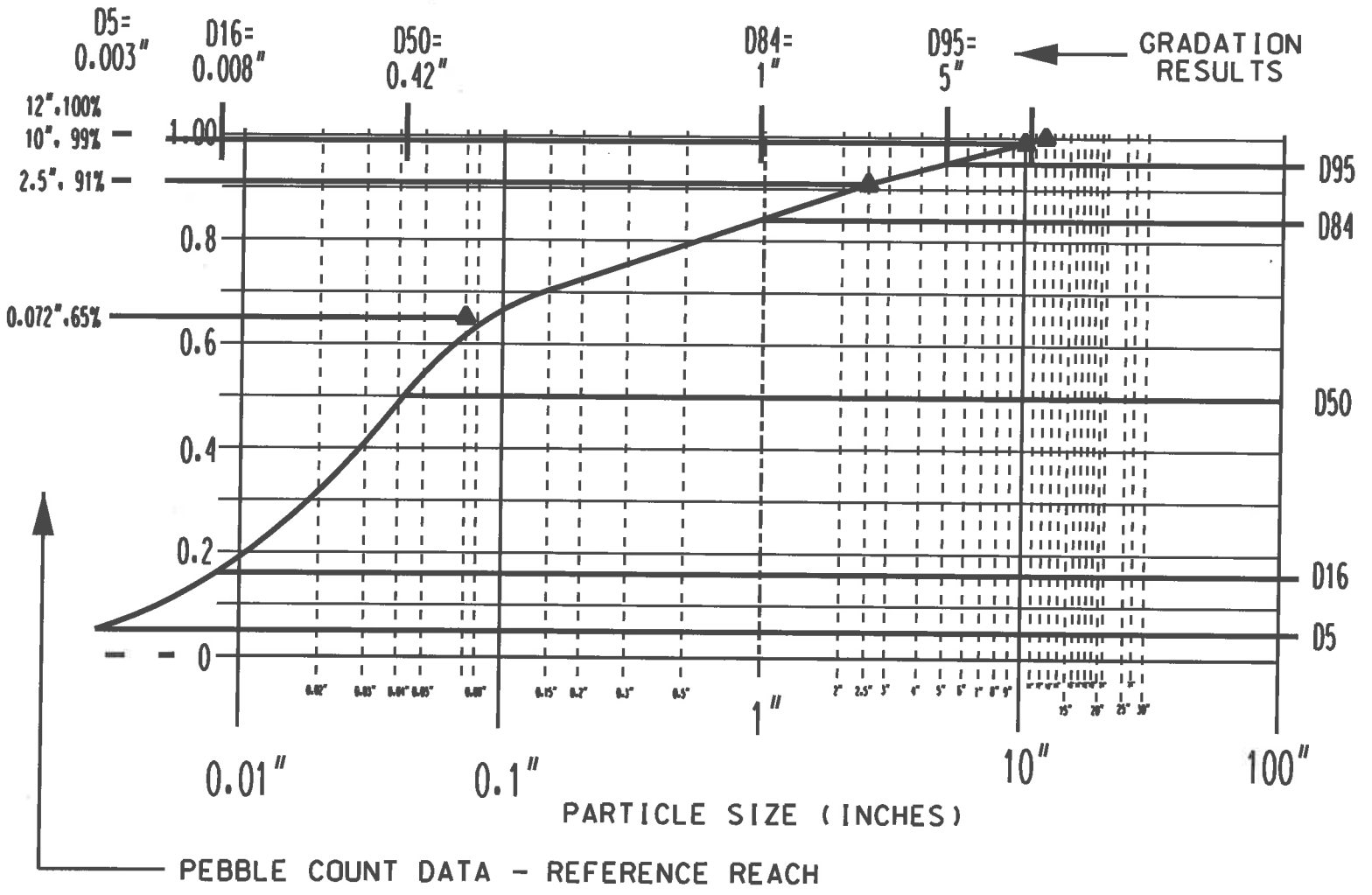
Application Version: 4.3.0



42363 NORTHWOOD



42363 NORTHWOOD



42363 NORTHWOOD

Photos for Digital Gradation Analysis
By NHDOT Highway Design 7/7/2019



Location – Approx. 100' upstream of culvert inlet



Location – Approx. 75' downstream of culvert inlet

Digital Gradation Analysis

Number of Photos: 3

☐ Advanced Controls

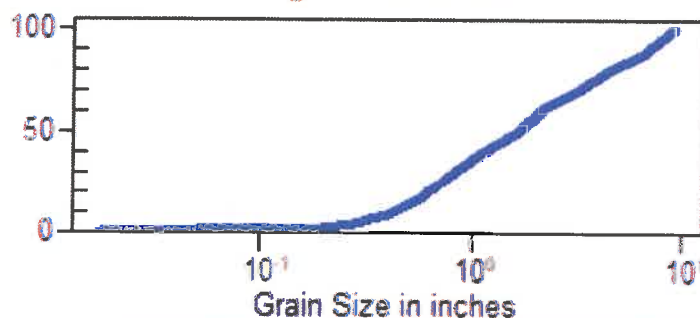
Correction Factor 2.500

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Browse...	N:\CADD\PBT\NORTHWOOD\42363\Cadd\Prj\Drainage\Hy...	Setup...	View...	Remove...	Not Found
Browse...	N:\CADD\PBT\NORTHWOOD\42363\Cadd\Prj\Drainage\Hy...	Setup...	View...	Remove...	Complete

Particle Size (in)	Particle Count	Cumulative Particle Count	Cumulative Percent Finer (%)
0.02	0	0	0.0
0.02	0	0	0.0
0.04	0	0	0.0
0.05	3	3	0.0
0.07	6	9	0.1
0.10	15	24	0.3
0.14	34	58	0.8
0.20	70	128	1.8
0.28	159	287	4.1
0.40	316	603	8.7
0.56	503	1106	16.0
0.80	858	1964	28.4
1.18	778	2742	38.6

Parameter	Value	Units
D5	0.30	in
D15	0.54	in
D50	1.67	in
D85	5.72	in
D100	9.02	in

Semi-log Gradation Plot



Plot Combined Gradation...

Plot All Gradations...

Recompute

OK

Cancel

FHWA Hydraulic Toolbox

Digital Photo Gradation Results - Upstream

42363 Northwood

Number of Photos: 4

☐ Advanced Controls

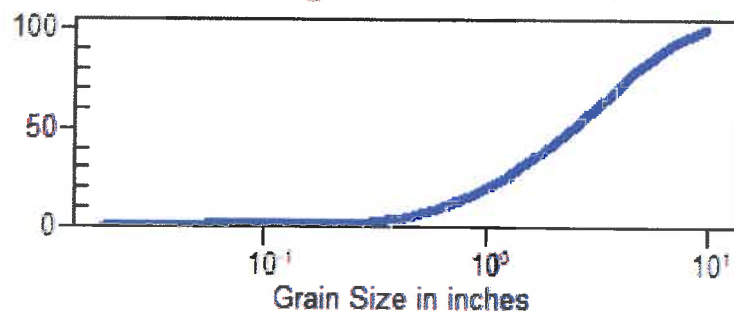
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Browse	Filename	Setup	View	Remove	Status
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Browse...	N:\CADD\PBT\NORTHWOOD\42363\Cadd\Prj\Drainage\Hy...	Setup...	View...	Remove...	Complete

Particle Size (n)	Particle Count	Cumulative Particle Count	Cumulative Percent Finer (%)
0.02	0	0	0.0
0.03	0	0	0.0
0.04	0	0	0.0
0.05	1	1	0.0
0.08	3	4	0.0
0.11	9	13	0.1
0.15	22	35	0.4
0.22	50	85	0.9
0.31	112	197	2.0
0.43	230	427	4.4
0.61	406	833	8.6
0.86	622	1455	15.0
1.18	827	2282	23.6

Parameter	Value	Units
D5	0.46	in
D15	0.86	in
D50	2.46	in
D85	5.72	in
D100	9.78	in

Semi-log Gradation Plot



Plot Combined Gradation...

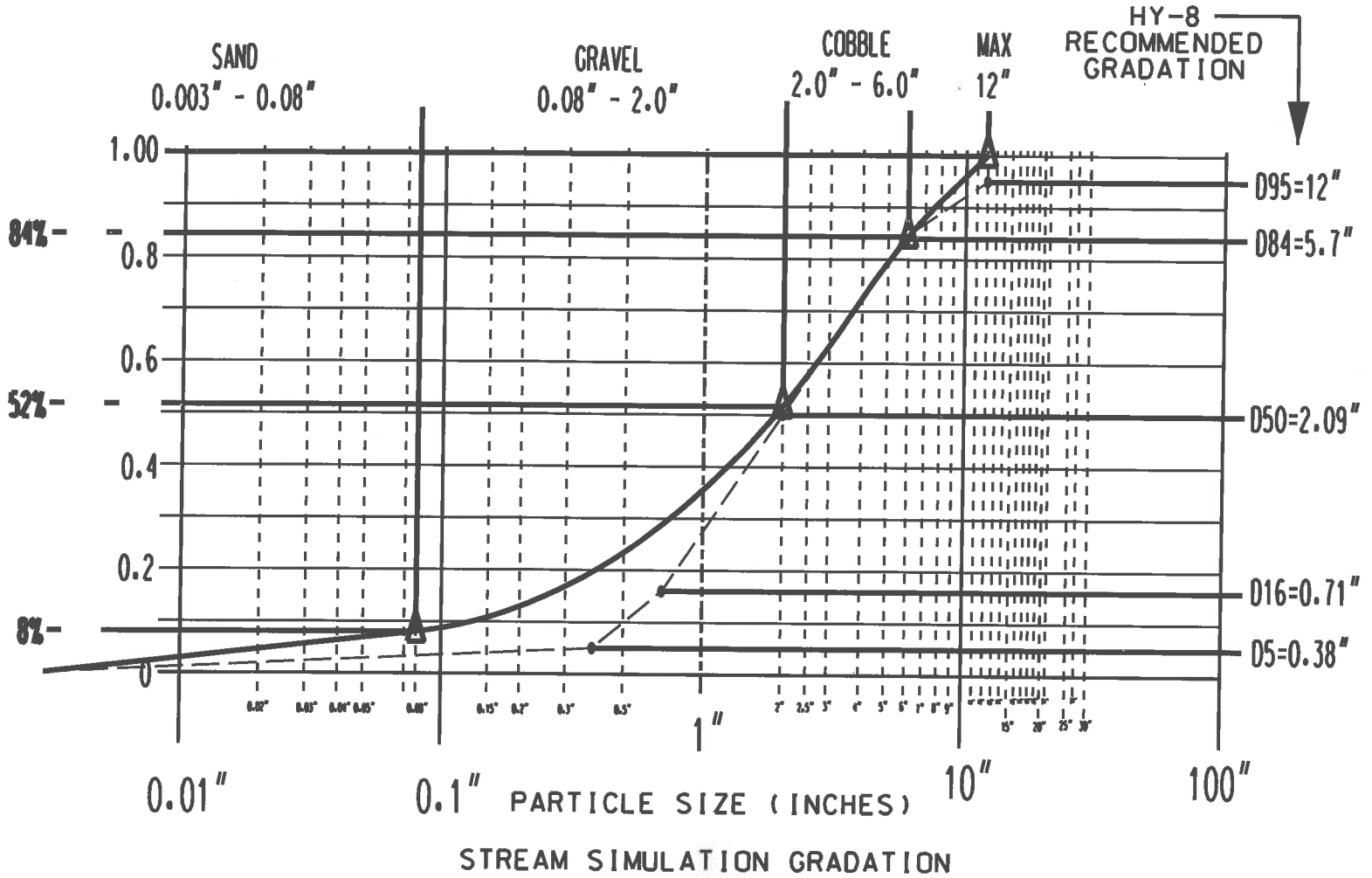
Plot All Gradations...

Recompute

OK

Cancel

PROPOSED STREAMBED GRADATION



42363 NORTHWOOD

Input Reach Data

Parameter	Value	Units	Notes
Flows for AOP (Step 1)			
Lowest Flow that still provides Aquatic Organism Passage	Specify		
Specified Flow	1.000	cfs	minimum flow is 1 cfs
Highest Flow that still provides Aquatic Organism Passage	Specify		
Specified Flow	10.000	cfs	
Peak Flow (Hydraulic Design Flow)	Specify		
Specified Flow	250.000	cfs	minimum flow is 1 cfs
Cross-Sections (Step 2)			
Length that project should extend up and downstream	200.00	ft	
Number of Cross-Sections Upstream of Crossing	3		
Number of Cross-Sections Downstream of Crossing	3		
Cross-Section Table			
Cross-Section Name	Station (ft)	Define	Thalweg (ft)
Upstream X-Sec	-150.00	Define	545.67
Upstream X-Sec	-90.00	Define	545.60
Upstream X-Sec	-25.00	Define	545.41
Culvert Inlet	0.00	NA	545.80
Culvert Outlet	44.00	NA	545.75
Downstream X-Sec	89.00	Define	545.04
Downstream X-Sec	90.00	Define	545.02
Downstream X-Sec	112.00	Define	545.85
			0.0100

Help

Edit Input Data...

Analyze Crossing

Energy Dissipation

Low Flow

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42363 Northwood

HY-8 AOP/Stream Simulation Input

Parameter	Value	Units	Notes	
Reach Channel Gradations (Step 2)				
Number of Gradations	2			
Gradation Table				
Gradation	Starts @ Station #1	Ends @ Station #1	Define	D50 (in)
Streambed Gradation	-150.00	0.00	Define	1.67
Streambed Gradation	44.00	112.00	Define	2.50
Reach Channel Manning's n Method				
<input checked="" type="checkbox"/> Manning's n Method for Reach Cross-Section	Budget		Method was selected by user	
Summary for Manning's n for Reach				
Criteria is met	15 out of 18 times			
Average Manning's n computed for reach cross sections	0.05			
Upstream Cross-Section				
Upstream X-Sec	n @ Low Flow	n @ High Flow	n @ Peak Flow	
	Criteria is met	Criteria is met	Criteria is met	
	0.05	0.04	0.03	
Upstream X-Sec	Criteria is met	Criteria is met	Criteria is met	
	0.05	0.04	0.03	
Upstream X-Sec	Criteria is NOT met	Criteria is met	Criteria is met	
	0.06	0.05	0.03	
Downstream Cross-Section				
Downstream X-Sec	n @ Low Flow	n @ High Flow	n @ Peak Flow	
	Criteria is met	Criteria is met	Criteria is met	
	0.05	0.04	0.04	
Downstream X-Sec	Criteria is NOT met	Criteria is met	Criteria is met	
	0.08	0.05	0.04	
Downstream X-Sec	Criteria is NOT met	Criteria is met	Criteria is met	
	0.11	0.06	0.04	

Reach Stability (Steps 3 & 4)			
Is Streambed in Dynamic Equilibrium?	Yes	This analysis needs to be performed in the field!	
Culvert Bed Gradations (Step 5)			
Upper Culvert Bed Gradation	View...	D50 = 2.09 in	
Culvert Bed Manning's n Method			
Manning's n Method for Culvert Bed Gradation	Mussetier	Criteria is met for this method at all flows	Method was selected by user
Manning's n computed at Low Flow	0.0615	Criteria is met at this flow	<input checked="" type="checkbox"/> Specify the Manning's n value
User-Specified Manning's n value at Low Flow	0.0500		This Manning's n value will be used at this flow!
Manning's n computed at High Flow	0.0423	Criteria is met at this flow	<input checked="" type="checkbox"/> Specify the Manning's n value

Help

Edit Input Data...

Analyze Crossing

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HY-8 AOP/Stream Simulation Input

Parameter	Value	Units
Align and Size Culvert (Step 5)	Results are updated immediately	
CULVERT DATA		
Name	5 x 9 Box	
Shape	Concrete Box	
Material	Concrete	
Span	9.000	ft
Rise	7.000	ft
Embedment Depth	24.000	in
Manning's n (Top/Sides)	0.012	
Manning's n at Low Flow (Bottom)	0.050	
Manning's n at High Flow (Bottom)	0.035	
Manning's n at Peak Flow (Bottom)	0.030	
Culvert Type	Straight	
Inlet Configuration	Beveled Edge	
Inlet Depression?	No	
SITE DATA		
Site Data Input Option	Culvert Invert Data	
Inlet Station	0.000	ft
Inlet Elevation	543.900	ft
Outlet Station	44.000	ft
Outlet Elevation	543.750	ft
Number of Barrels	1	

Parameter	Value	Units
Embedment Depth Check (Step 5)		
Embedment Depth is Acceptable		
Adjust Embedment to Match Required Embedment Depth and	Adjust	
Embedment Depth	2.000	ft
Acceptable Embedment Depth	2.000	ft
HW/D	0.880	
Culvert Bed Stability Under High Flow		
Bed is Stable under High Flow (Step 6)		
Bed Mobility is Acceptable under High Flow, bed...		
Optimize Culvert Barrel Size for Shear	Optimize	
Streambed is NOT Mobile at any Cross-Sections		
Shear Applied to Culvert Bed under High Flow	0.598	pcf
Shear Permissible to Culvert Bed's Upper Layer	1.133	pcf
Minimum Shear Applied to Reach Cross-Sections under High	0.055	pcf
Maximum Shear Applied to Reach Cross-Sections under High	0.652	pcf
Culvert Bed Stability Under Peak Flow		
Bed is NOT Stable under Peak Flow (Step 8)		
Lower Layer Bed is Stable under Peak Flow (Step 9)		
Lower Culvert Bed Gradation	View...	D5...
Enable User-Specified Lower Layer Bed Gradation		
Shear Applied to Culvert Bed under Peak Flow	2.450	pcf
Shear Permissible to Culvert Bed's Lower Layer	2.450	pcf
Maximum Shear Applied to Reach Cross-Sections under Peak	3.579	pcf
Culvert Velocity Check (Step 10)		
Culvert Velocity is Acceptable		
Optimize Culvert Barrel Size for Velocity	Optimize	
Maximum Velocity within Culvert under High Flow	3.072	ft/s
Maximum Velocity within Reach Cross-Sections under High Flow	3.103	ft/s
Culvert Depths (Step 11)		
Culvert Depth is NOT Acceptable		
Minimum Depth within Culvert under Low Flow	0.031	ft
Minimum Depth within Reach Cross-Sections under Low Flow	0.102	ft
Create Low Flow Channel in Culvert's Embedment? (Step 12)		
This Low Flow Channel will only change the culvert geometry...		

Help

Edit Input Data...

Analyze Crossing

Energy Dissipation

Low Flow

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** Flow depths (for 1 cfs baseflow) differ by only 0.011' (about 1/8"),
 This meets the standard of "comparable" in 904.05

42363 Northwood

HY-8 AOP/Stream Simulation Output

Parameter	Value	Units	Notes
Review (Step 13)			
Upstream Cross-Section Calculations under High Flow			
Upstream X-Sec			
Normal Depth	0.77	ft	
Velocity	1.07	ft/s	
Shear	0.06	psf	
Upstream X-Sec			
Normal Depth	0.77	ft	
Velocity	1.32	ft/s	
Shear	0.14	psf	
Upstream X-Sec			
Normal Depth	0.43	ft	
Velocity	3.10	ft/s	
Shear	0.66	psf	
Downstream Cross-Section Calculations under High Flow			
Downstream X-Sec			
Normal Depth	0.43	ft	
Velocity	3.10	ft/s	
Shear	0.66	psf	
Downstream X-Sec			
Normal Depth	1.20	ft	
Velocity	1.02	ft/s	
Shear	0.07	psf	
Downstream X-Sec			
Normal Depth	0.50	ft	
Velocity	1.61	ft/s	
Shear	0.18	psf	
Shear Calculations under High Flow			
Energy Slope	0.0011	ft/ft	
Culvert Bed Stability under High Flow			
D50 of Upper Gradation Layer	0.174	ft	
V _u under High Flow	0.1616		
Reynolds value under High Flow	2592.91		
Shield's value under High Flow	0.0470		
Permissible Shear for Upper Gradation Layer under High Flow	1.13	psf	
Maximum Shear for Applied to the Culvert Bed under High Flow	0.51	psf	
Maximum Shear Applied to Reach Cross-Sections under High Flow	0.662	psf	

Help

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Analyze Crossing

Energy Dissipation

Low Flow

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HY-8 AOP/Stream Simulation Output

SPECIAL PROVISION**AMENDMENT TO SECTION 585 – STONE FILL****Item 585.340X – Simulated Streambed Material****Add** to Description:

1.2 This work shall consist of furnishing and placing Simulated Streambed Material at the following location on this project:

Simulated Streambed Material shall be placed 24” thick at the inlet and outlet, and 6” thick within the culvert as shown on the Plans.

1.2.1 The intent is to replicate the natural streambed environments upstream and downstream of the culvert. The percentage of specific stream bed material was determined in the field utilizing the Wolman Pebble Count methodology. The gradation of substrate particle sizes are based on the Wentworth scale as referenced in the Guidelines for Naturalized River Channel Design and Bank Stabilization.

Add to Materials:

2.1.6 Simulated Streambed Material shall meet the following gradations:

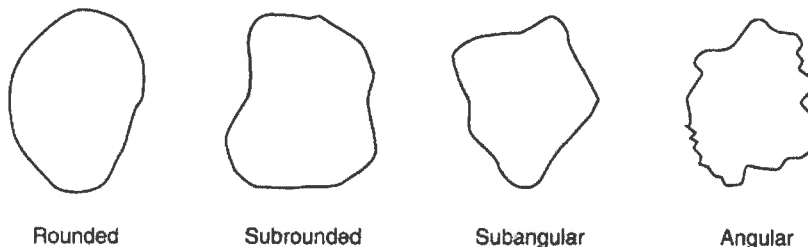
Upstream and Downstream Gradation		
	% by Weight	Sieve Sizes (in)
Sand	8%	0.003 to 0.08 (smaller than head of a match)
Gravel	44%	0.08 to 2.0 (between head of match and tennis ball)
Cobble	32%	2.0 to 6.0 (between tennis ball and volleyball)
Boulder	16%	6.0 to 12.0 (max of 12” on any axis)

Gradation inside the Culvert		
	% by Weight	Sieve Sizes (in)
Sand	8%	0.003 to 0.08 (smaller than head of a match)
Gravel	44%	0.08 to 2.0 (between head of match and tennis ball)
Cobble	48%	2.0 to 6.0 (between tennis ball and volleyball)

2.1.6.1 Streambed Material depth shall be as noted in the Plans. The depth may be modified as directed by the Engineer such that removal of bedrock and boulders greater than 24" diameter is not required and any voids created by excavation below Plan sub-grade are filled.

2.1.6.2 Gravel, Cobble, and Boulder particle shape shall be **Rounded or Subrounded** in accordance with the following:

R = Rounded, Sub-R = Subrounded, Sub-A = Subangular, A = Angular



2.1.6.3 Existing streambed material may be salvaged, stockpiled, and reused under this Item.

Add to 3.1:

3.1.3 In accordance with the *Guidelines for Naturalized River Channel Design and Bank Stabilization*, specifically 2.2.1.2 Semi-Natural Form Design, the Streambed Material shall be placed directly on the existing channel floor or subgrade as shown in the contract plans. In cases where scour protection or streambed anchorage material is required the scour/anchorage material shall be placed first. Then the Streambed Material shall be worked into the top 1'-0" filling voids, followed by the depth of Streambed Material specified.

3.1.4 Do not remove streambed material that is not disturbed by other construction operations.

Method of Measurement

Add to Method of Measurement:

4.2 Simulated Streambed Material will be measured by the cubic yard.

Basis of Payment

Add to Basis of Payment:

5.1.1 The accepted quantity of Simulated Streambed Material will be paid for at the Contract unit price per cubic yard complete in place.

Add to Pay Items and Units:

585.3401

Simulated Streambed Material




Cubic Yard

SHEET NO. 1 OF 1
STA. 102+77 OFF. LT 11
BASELINE NH Rte 107 CL
ELEVATION (ft) 553.5
START/END 7/15/19 / 7/15/19
DRILLER J. Woodward (NHDOT)
INSPECTOR Kyle Ashe
CLASSIFIER KRA
EAST/NORTH (ft) 1096019/266254

GROUNDWATER						EQUIPMENT SAMPLER CASING CORE				START/END 7/15/19 / 7/15/19	
DATE	TIME	DEPTH (ft)	ELEV. (ft)	BOTTOM OF CASING	BOTTOM OF HOLE	TYPE:	S	NW	NX	DRILLER J. Woodward (NHDOT)	
7/15/19	11:38 am	4.6	548.9	10.9	15.9	SIZE I.D. (in):	1.375	3	1.875	INSPECTOR Kyle Ashe	
						HAMMER WT. (lb):	140	DRILL RIG		CLASSIFIER KRA	
						HAMMER FALL (in):	30			EAST/NORTH (ft) 1096019/266254	
						HAMMER TYPE:	Automatic	CME 45-C Trlr			
DEPTH (ft)	STRATUM CHANGE (ft)		BLOWS PER 0.5 ft	SAMPLE NUMBER	SAMPLER RECOVERY (ft) [%]	DEPTH RANGE (ft)	FIELD CLASSIFICATION AND REMARKS				STRATUM SYMBOL
	DEPTH	ELEVATION									
0	0.5	553.0					-ASPHALT-				
			10			1.0	Medium dense, orange brown, FINE - MEDIUM SAND, little gravel, trace silt, pieces of asphalt				
			7 6	S1	0.8 [40]						
			10			3.0	-FILL-				
			4			3.0	Medium dense, brown, FINE - COARSE SAND, trace gravel, trace silt				
			9 15	S2	0.4 [20]						
5			13			5.0					
			10			5.0	Loose, orange brown, MEDIUM SAND, some fine gravel, little coarse sand, little fine sand, trace silt				
			6 4	S3 (SP-SM)	0.7 [35]						
			6			7.0					
			6 6	S4	0.4 [20]		Medium dense, orange brown, FINE - MEDIUM SAND, trace silt, trace coarse sand				
			8			9.0					
10	9.8	543.7	13								
			10	S5 (SM)	1.2 [63]		Medium dense, gray, FINE SAND, some silt, little f - gravel, little m - sand, trace c - gravel, trace c - sand, trace clay (-GLACIAL TILL-)				
	10.9	542.6	30/0.4			10.9	-APPROXIMATE BEDROCK SURFACE-				
				C1	4.9 [98]		Moderately hard, slightly weathered, extremely fractured, gray, fine grained PHYLLITE, close horizontal foliation, horizontal bedding, with pink Calcite stringers (15' - 15.9'); several mechanical breaks were observed RQD: 0.9 / 5.0 = 18%				
15						15.9					
							Bottom of Exploration @ 15.9 ft (El. 537.6)				
20											
25											

Sampler Identification		COHESIVE SOILS		NON-COHESIVE SOILS		Soil Descriptions	Proportion
S	Standard Split Spoon	<u>Blows/foot (N)</u>	<u>Consistency</u>	<u>Blows/foot (N)</u>	<u>Apparent Density</u>	Capitalized Soil Name	Major Component
SL	Large Spoon (O.D.= 3 in)	0 - 1	Very Soft	0 - 4	Very Loose	Lower Case Adjective	35% - 50%
T	Thin Wall Tube	2 - 4	Soft	5 - 10	Loose	Some	20% - 35%
U	Undisturbed Piston	5 - 8	Medium Stiff	11 - 30	Medium Dense	Little	10% - 20%
O	Open End Rod	9 - 15	Stiff	31 - 50	Dense	Trace	1% - 10%
A	Auger Flight	16 - 30	Very Stiff	> 50	Very Dense		
C	Core Barrel	> 30	Hard				
NR	Not Recorded			WOR - Weight of Rod WOH - Weight of Hammer		ENGLISH	

TB-12 S:\MATERIALS-RESEARCH\GINTW\PROJECTS\NORTHWOOD\42363\NORTHWOOD 42363.GPJ 9/6/2019 8:28:28 AM TB-12

TEST BORING REPORT										BORING NO. B02		
STATE OF NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION MATERIALS & RESEARCH BUREAU - GEOTECHNICAL SECTION												
PROJECT NAME NORTHWOOD 42363 BRIDGE NO. N/A										SHEET NO. 1 OF 1		
DESCRIPTION NH Rte 107N (Main Street) CMP Arch Culvert Replacement										STA. 102+68 OFF. RT 11		
										BASELINE NH Rte 107 CL		
										ELEVATION (ft) 553.7		
										START/END 7/15/19 / 7/15/19		
										DRILLER J. Woodward (NHDOT)		
										INSPECTOR Kyle Ashe		
										CLASSIFIER KRA		
										EAST/NORTH (ft) 1095998/266244		
GROUNDWATER						EQUIPMENT	SAMPLER	CASING	CORE			
DATE	TIME	DEPTH (ft)	ELEV. (ft)	BOTTOM OF CASING	BOTTOM OF HOLE	TYPE:	S	NW	NX			
7/15/19	2:22 pm	5.6	548.1	10.1	14.9	SIZE I.D. (in):	1.375	3	1.875			
						HAMMER WT. (lb):	140	DRILL RIG				
						HAMMER FALL (in):	30	CME 45-C Trlr				
						HAMMER TYPE:	Automatic					
DEPTH (ft)	STRATUM CHANGE (ft)		BLOWS PER 0.5 ft	SAMPLE NUMBER	SAMPLER RECOVERY (ft) [%]	DEPTH RANGE (ft)	FIELD CLASSIFICATION AND REMARKS					STRATUM SYMBOL
0	DEPTH	ELEVATION										
0.5	553.2		6	S1 (SP-SM)	0.5 [25]	1.0	-ASPHALT- Loose, orange brown, gravelly MEDIUM SAND, little coarse sand, little fine sand, trace silt, pieces of asphalt					
			6 WOH			3.0	-FILL- No recovery					
			1 WOH	S2	0.0 [0]		No sample taken due to casing dropping; moved to next interval					
5			3	S3	0.3 [15]	7.0	Loose, gray, MEDIUM - COARSE SAND, little gravel, trace silt					
9.0	544.7		24	S4 (SM)	0.5 [45]	9.0	Gray, MEDIUM - FINE SAND, some f - gravel, some silt, little c - sand, trace clay (-GLACIAL TILL-)					
10.1	543.6		40			10.1	-APPROXIMATE BEDROCK SURFACE- Moderately hard, slightly weathered, extremely fractured, gray, fine grained PHYLLITE, close horizontal foliation, horizontal bedding; several mechanical breaks were observed RQD: 0.8 / 4.8 = 17%					
15				C1	4.5 [94]	14.9	Bottom of Exploration @ 14.9 ft (El. 538.8)					
20												
25												

Sampler Identification		COHESIVE SOILS		NON-COHESIVE SOILS		Soil Descriptions		Proportion	
S	Standard Split Spoon	Blows/foot (N)	Consistency	Blows/foot (N)	Apparent Density	Capitalized Soil Name	Major Component		
SL	Large Spoon (O.D.= 3 in)	0 - 1	Very Soft	0 - 4	Very Loose	Lower Case Adjective	35% - 50%		
T	Thin Wall Tube	2 - 4	Soft	5 - 10	Loose	Some	20% - 35%		
U	Undisturbed Piston	5 - 8	Medium Stiff	11 - 30	Medium Dense	Little	10% - 20%		
O	Open End Rod	9 - 15	Stiff	31 - 50	Dense	Trace	1% - 10%		
A	Auger Flight	16 - 30	Very Stiff	> 50	Very Dense				
C	Core Barrel	> 30	Hard	WOR - Weight of Rod WOH - Weight of Hammer					
NR	Not Recorded								

ENGLISH

TB-12 S:\MATERIALS-RESEARCH\GINT\PROJECTS\NORTHWOOD\42363\NORTHWOOD 42363.GPJ 9/6/2019 8:28:29 AM TB-12

**NH Department of Transportation
Bureau of Highway Design
Project, 42363
Env-Wt 904.09 Alternative Design
TECHNICAL REPORT**

Env-Wt 904.09(a) - If the applicant believes that installing the structure specified in the applicable rule is not practicable, the applicant may propose an alternative design in accordance with this section.

Please explain why the structure specified in the applicable rule is not practicable (Env-Wt 101.69 defines practicable as *available and capable of being done after taking into consideration costs, existing technology, and logistics in light of overall project purposes.*)

NHDOT Bureau of Environment performed a Stream Assessment (attached), which determined the compliant structure span is 28'. This would involve constructing a significant size Bridge, with a Construction Cost of approximately \$1.5 million, at least a 1 year delay in engineering, and road closure for about 3 months. Shallow bedrock found by soil borings (attached) may significantly increase the cost and impacts associated with construction of a Bridge.

The subject culvert is in poor condition, with frequent sinkholes developing, and has a high risk of failure. This project has limited State funds available for summer 2020 construction. The estimated cost for the proposed 5' x 9' embedded culvert is \$500,000, and construction can be accomplished while maintaining one lane of traffic through the work area.

The proposed culvert embedment depth was modified from 24" to 6" to avoid the potential costs and impacts associated with rock removal. Blasting would likely be required to achieve 24" embedment and this could adversely impact the historic property adjacent to the outlet (VFW Hall). The depth of embedment has no effect on hydraulic capacity or water depth / velocity calculations.

The proposed alternative meets the specific design criteria for Tier 2 and Tier 3 crossings to the maximum extent practicable, as specified below.

Env-Wt 904.05 Design Criteria for Tier 2 and Tier 3 Stream Crossings – New Tier 2 stream crossings, replacement Tier 2 crossings that do not meet the requirements of Env-Wt 904.07, and new and replacement Tier 3 crossings shall be designed and constructed:

(a) In accordance with the NH Stream Crossing Guidelines.

The proposed culvert is the maximum size practicable considering cost, construction schedule, and impacts to wetlands, adjacent private development, historic resources, and the travelling public. The proposed culvert is sized to pass the 50 year design storm without submerging the inlet and to convey the 100 year design storm without overtopping the road or causing damage to private property.

The proposed design has evaluated and addressed (where practicable) all of the considerations listed in the NH Stream Crossing Guidelines, Section IV – Guidelines for Stream Crossing Structure Replacement.

(b) With bed forms and streambed characteristics necessary to cause water depths and velocities within the crossing structure at a variety of flows to be comparable to those found in the natural channel upstream and downstream of the stream crossing.

FHWA's HY-8 Culvert Analysis Program was used for stream simulation design (a copy of the input and results are attached). Program results indicate that water depths and velocities within the crossing structure at a variety of flows will be comparable to those found in the natural channel upstream and downstream of the stream crossing. The Program uses "Low, High, and Peak" flows to evaluate the design. Streamstats 2 year 7 day low flow prediction is 0.32 cfs. Low flow was set to the minimum 1 cfs. High flow was estimated at 10 cfs. Peak flow was set at the 50 year design flow of 250 cfs.

(c) To provide a vegetated bank on both sides of the watercourse to allow for wildlife passage.

The proposed culvert cannot accommodate a vegetated bank on both sides of the watercourse.

(d) To preserve the natural alignment and gradient of the stream channel, so as to accommodate natural flow regimes and the functioning of the natural floodplain.

The existing and proposed culverts match the stream alignment and gradient. The proposed project will not significantly alter existing adjacent flood plain where it currently exists.

(e) To accommodate the 100-year frequency flood, to ensure that (1) there is no increase in flood stages on abutting properties; and (2) flow and sediment transport characteristics will not be affected in a manner which could adversely affect channel stability.

The existing and proposed culverts were analyzed using FHWA's HY-8 Culvert Analysis Program. Results indicate that the proposed culvert will pass the 100 year design flow with headwater elevation of 551.67, which is 0.13' lower than the adjacent garage building sill and 0.83' lower than the lowest NH 107 edge of pavement. For comparison, the existing headwater elevation required to pass 340 cfs is 553.46, which is about 1 foot higher than the NH 107 edge of pavement.

Stream Simulation analysis indicates that water depths and velocities within the crossing structure at a variety of flows will be comparable to those found in the natural channel upstream and downstream of the stream crossing, therefore sediment transport and channel stability characteristics will be similar to those in the upstream and downstream channels.

(f) To simulate a natural stream channel.

Proposed streambed materials and gradation will be comparable to those found in the natural channel upstream and downstream of the stream crossing. Existing and proposed bed material gradations are attached for reference. Existing stone bank protection will be reset along the banks in the vicinity of the culvert inlet and outlet. No riprap will be placed in the streambed.

(g) So as not to alter sediment transport competence.

Stream Simulation analysis indicates that water depths and velocities within the crossing structure at a variety of flows will be comparable to those found in the natural channel upstream and downstream of the stream crossing, therefore sediment transport characteristics will be similar to those in the upstream and downstream channels.

Env-Wt 904.09(c)(3) – The alternative design must meet the general design criteria specified in Env-Wt 904.01:

Env-Wt 904.01

(a) Not be a barrier to sediment transport;

There are no features within the proposed culvert that would be a barrier to sediment transport. There is no evidence of significant erosion or aggradation in the existing culvert or adjacent channels. Stream Simulation analysis indicates that water depths and velocities within the crossing structure at a variety of flows will be comparable to those found in the natural channel upstream and downstream of the stream crossing, therefore sediment transport characteristics will be similar to those in the upstream and downstream channels.

(b) Prevent the restriction of high flows and maintain existing low flows;

Stream Simulation analysis indicates that water depths and velocities within the crossing structure at a variety of flows will be comparable to those found in the natural channel upstream and downstream of the stream crossing. The culvert will not restrict high flows, and will maintain low flow depth and velocity.

(c) Not obstruct or otherwise substantially disrupt the movement of aquatic life indigenous to the waterbody beyond the actual duration of construction;

The proposed culvert has no features that would substantially disrupt the movement of aquatic life indigenous to the waterbody.

(d) Not cause an increase in the frequency of flooding or overtopping of banks;

The proposed culvert will increase the crossing capacity significantly, reducing the depth of high flows.

(e) Preserve watercourse connectivity where it currently exists;

The existing culvert is not perched and typically has baseflow with consistent depth and velocity. The proposed culvert and simulated streambed will maintain connectivity.

(f) Restore watercourse connectivity where: (1) Connectivity previously was disrupted as a result of human activity(ies); and (2) Restoration of connectivity will benefit aquatic life upstream or downstream of the crossing, or both;

The proposed culvert will improve connectivity by shortening the overall length of the crossing and by providing a natural streambed through the structure.

(g) Not cause erosion, aggradation, or scouring upstream or downstream of the crossing; and

There is no evidence of significant erosion or aggradation in the existing culvert or adjacent channels. Stream Simulation analysis indicates that water depths and velocities within the crossing structure at a variety of flows will be comparable to those found in the natural channel upstream and downstream of the stream crossing, therefore sediment transport characteristics will be similar to those in the upstream and downstream channels.

(h) Not cause water quality degradation.

The proposed culvert will have no effect on water quality.

CONFIDENTIAL – NH Dept. of Environmental Services review

Memo



NH NATURAL HERITAGE BUREAU
NHB DATACHECK RESULTS LETTER

To: Arin Mills, NH Department of Transportation
John O. Morton Building
7 Hazen Drive
Concord, NH 03302-0483

From: Amy Lamb, NH Natural Heritage Bureau
Date: 2/5/2019 (valid for one year from this date)
Re: Review by NH Natural Heritage Bureau
NHB File ID: NHB19-0430

Town: Northwood Location: Culvert under NH Route 107 in unnamed tributary to Narrows Brook
Description: Replace a 5' high by 7' wide corrugated metal pipe (CMP) carrying and un-named tributary of Narrow Brook under NH Route 107, located approximately 230' northwest of High Street. Incidental work includes replacement of a 12" cmp closed drainage pipe at culvert outlet and construction of short runs of new guardrail on both side of NH Route 107.
cc: Kim Tuttle

As requested, I have searched our database for records of rare species and exemplary natural communities, with the following results.

Comments: Please contact the NH Fish & Game Department to address wildlife concerns.

Vertebrate species

Spotted Turtle (*Clemmys guttata*)*

State ¹	Federal	Notes
T	--	Contact the NH Fish & Game Dept (see below).

¹Codes: "E" = Endangered, "T" = Threatened, "SC" = Special Concern, "--" = an exemplary natural community, or a rare species tracked by NH Natural Heritage that has not yet been added to the official state list. An asterisk (*) indicates that the most recent report for that occurrence was more than 20 years ago.

Contact for all animal reviews: Kim Tuttle, NH F&G, (603) 271-6544.

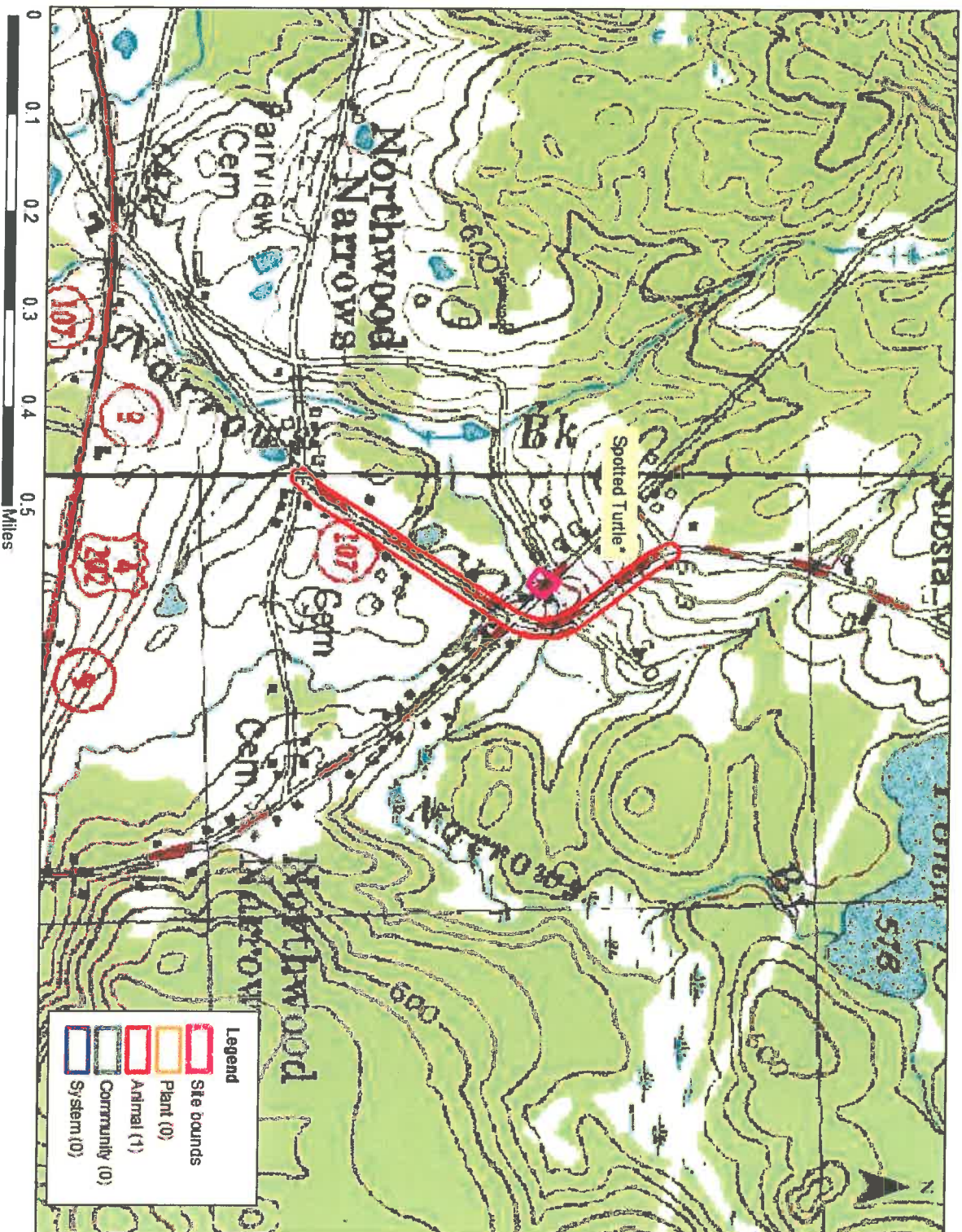
A negative result (no record in our database) does not mean that a sensitive species is not present. Our data can only tell you of known occurrences, based on information gathered by qualified biologists and reported to our office. However, many areas have never been surveyed, or have only been surveyed for certain species. An on-site survey would provide better information on what species and communities are indeed present.

Department of Natural and Cultural Resources
Division of Forests and Lands
(603) 271-2214 fax: 271-6488

DNCR/NHB
172 Pembroke Rd.
Concord, NH 03301

CONFIDENTIAL – NH Dept. of Environmental Services review

NHB19-0430



New Hampshire Natural Heritage Bureau - Animal Record

Spotted Turtle (*Clemmys guttata*)**Legal Status**

Federal: Not listed
State: Listed Threatened

Conservation Status

Global: Demonstrably widespread, abundant, and secure
State: Imperiled due to rarity or vulnerability

Description at this Location

Conservation Rank: Historical records only - current condition unknown.
Comments on Rank:

Detailed Description: 1991: Road kill found by D. Sperduto.

General Area:

General Comments:

Management

Comments:

Location

Survey Site Name: Northwood, Rte. 107
Managed By:

County: Rockingham

Town(s): Northwood

Size: 5.6 acres

Elevation:

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: Northwood. Road kill seen on Route 107 ca. 0.5 miles north of junction with Route 4.

Dates documented

First reported: 1991

Last reported: 1991-05

The New Hampshire Fish & Game Department has jurisdiction over rare wildlife in New Hampshire. Please contact them at 11 Hazen Drive, Concord, NH 03301 or at (603) 271-2461.

From: Tuttle, Kim
Sent: Thursday, July 25, 2019 9:34 AM
To: Mills, Arin
Cc: Henderson, Carol
Subject: RE: NHB19-0430 Narrow Brook Rt. 107 crossing Northwood

Hi Arin,

Not really interested in the stamped concrete alternative at this location. I would consider something like this in a location with more velocity. Thanks for finding out where the '2' embedment' spec came from-

Kim Tuttle
Wildlife Biologist
NH Fish and Game
11 Hazen Drive
Concord, NH 03301
603-271-6544

From: Mills, Arin
Sent: Thursday, July 25, 2019 9:27 AM
To: Tuttle, Kim
Cc: Henderson, Carol
Subject: RE: NHB19-0430 Narrow Brook Rt. 107 crossing Northwood

Thanks Kim, I will pass that along to our designers. In a discussion with him yesterday he said the design manual calls for 2' embedment, although he was not sure why that was the depth either. From a design perspective he does not feel 2' is needed either. Still no baffles/sills are proposed in the design.

Do you have concerns for the stamped concrete alternative? Is there one design you would prefer? The designer is looking into both alternatives and wanted to move forward with a design that would be acceptable to your agency.

Thanks for your time!

Arin

From: Tuttle, Kim
Sent: Thursday, July 25, 2019 9:19 AM
To: Mills, Arin
Cc: Henderson, Carol
Subject: RE: NHB19-0430 Narrow Brook Rt. 107 crossing Northwood

Arin,

We don't need any box culvert embedded 2'. Not quite sure why that number keeps popping up in reviews. A 6" embedded box is acceptable at this location. No bed retention sills – sometimes referred to as baffles.

Regards,

Kim Tuttle
Wildlife Biologist
NH Fish and Game
11 Hazen Drive
Concord, NH 03301
603-271-6544

From: Mills, Arin
Sent: Wednesday, July 24, 2019 11:08 AM
To: Tuttle, Kim
Cc: Henderson, Carol
Subject: RE: NHB19-0430 Narrow Brook Rt. 107 crossing Northwood

Kim,

Some geotechnical work was done at the site last week and soil borings determined there is shallow bedrock in the location of the proposed culvert. That now makes the 2' (24") embedded box culvert not possible. The designer/hydrologist has determined two potential designs given this new information:

1. 6" embedded culvert or
2. Textured (stamped) concrete bottom culvert

Based on his analysis he feels both alternatives should perform about the same, with flow depths and velocities in the culvert similar to that in the stream channel. No change to the proposed culvert clear opening, length, slope, or high flow capacity. He also says the stream has a significant base flow, at least 6"-12" deep, for most of the year.

The textured concrete bottom is a new design that has not been used here within the Department. I have attached a sheet which provides a bit more information on this textured culvert design. Note that this example shows simulated boulders, but that would not be necessary in this application as the stream has low flow velocities.

I should also mention that an assessment of the stream bottom has also been done since the last review so that either alternative design can more closely resemble the existing stream bottom.

Because of this design change we are considering bringing this back (previously discussed at June meeting) to the August natural resource agency meeting. Can you please provide comment on these design alternatives as it relates to your agency concerns. This information will help us in determining the preferred alternative.

Feel free to reach out with any additional questions.

Thanks!

Arin Mills
Environmental Manager, Operations Management
NH Department of Transportation
Bureau of Environment
7 Hazen Drive, Concord, NH 03302
Ph: (603)271-0187
Arin.mills@dot.nh.gov

From: Tuttle, Kim
Sent: Tuesday, June 18, 2019 8:33 AM
To: Mills, Arin
Cc: Henderson, Carol
Subject: RE: NHB19-0430 Narrow Brook Rt. 107 crossing Northwood

Hello Arin,

The Narrow Brook Rt. 107 crossing should improve aquatic species passage opportunities for the state threatened spotted turtle with the larger culvert size and reduced length to 24' as long as the extra capacity is not lost by embedding it too deeply. One foot should be sufficient. Spotted turtle are not particularly strong swimmers. We hope that you will not be using bed retention sills within the culvert as they can become a barrier to turtles in low water conditions if the simulated stream bed materials used in 'embedding' the culvert are undersized and blown out in a flood event. We would rather that bed retention sills are not used and a variety of stone/small boulder sizes and gravel are used to lock everything in place. Please let me know if you have any questions about this job.

Regards,

Kim Tuttle
Wildlife Biologist
NH Fish and Game
11 Hazen Drive
Concord, NH 03301
603-271-6544

From: Mills, Arin
Sent: Tuesday, June 18, 2019 8:16 AM
To: Tuttle, Kim
Subject: RE: NHB19-0430 Narrow Brook Rt. 107 crossing Northwood

Kim,

Sorry it has taken so long to respond, we were gathering the necessary data and developing a design plan to answer your questions/concerns. The information you have provided is helpful and we incorporated it into the design. Below is a summary of the concerns you mentioned with a bit of discussion:

- The proposed replacement is a 5' high x 9' wide embedded 24" box culvert. This culvert is approx.. 12' shorter than the existing culvert in length. The box will be embedded and filled with simulated streambed material to simulate the natural stream conditions. The stream channel will be widened to a minimum of 9' width to match the channel width above/below the culvert, up to 20' upstream to 10' downstream of the new culvert. Existing stone will be reset along the bank. Simulated streambed will also be extended up and downstream.
- The 12" cmp is a closed drainage pipe which accepts roadside drainage from a catchbasin 80' – 100' north along Route 107. This pipe will be replaced as part of the project.
- We will include the wildlife friendly erosion control methods in the erosion control to protect wildlife. The exact type has not been determined, but we will specify wildlife friendly, as you recommended.
- Armoring of the stream will use the existing round river stones, they will be replaced to re-arm the bank. If additional stones are needed similar round river stones will be used. The stream bottom will simulate natural material to facilitate wildlife passage.
- I have attached a photo sheet of the existing conditions which I believe will help with your review. I have also included the recent design plan for your review.

Let me know if you have any additional concerns for the project. This project will be reviewed at tomorrows (June 19) natural resource agency meeting.

Arin Mills
Environmental Manager, Operations Management
NH Department of Transportation
Bureau of Environment
7 Hazen Drive, Concord, NH 03302
Ph: (603)271-0187
Arin.mills@dot.nh.gov

From: Tuttle, Kim
Sent: Wednesday, February 20, 2019 8:37 AM
To: Mills, Arin
Subject: NHB19-0430 Narrow Brook Rt. 107 crossing Northwood

Hi Arin,

What are you thinking of putting in? A bridge? What is the 12" cmp closed drainage pipe at culvert outlet for? Do you have a photo of the 12" cmp as well as the current 5' by 7' CMP stream crossing? Please avoid the use of welded plastic or 'biodegradable plastic' netting or thread in erosion control matting consistent with our previous recommendations for protected turtles. There are numerous

documented cases of snakes and other wildlife being trapped and killed in erosion control matting with synthetic netting and thread. The use of erosion control berm, Filtrexx or equal filter sock, or several 'wildlife friendly' options such as woven organic material (e.g. coco or jute matting such as North American Green SC150BN or equivalent) are commercially available, if needed. Please let us know what you intend on using.

Also, we recommend that natural stone be used for armoring of the abutments in the stream. We do not recommend the use of rip-rap across the entire width of the entire stream bottom. We will write our final review once the final design is determined.

Thanks,

Kim Tuttle
Wildlife Biologist
NH Fish and Game
11 Hazen Drive
Concord, NH 03301
603-271-6544

From: Mills, Arin
Sent: Tuesday, February 19, 2019 2:44 PM
To: Tuttle, Kim
Subject: NHB Review NHB19-0430, Northwood

Hello Kim,

The online review referenced above identified a historic (1991) record of Spotted turtle in the vicinity of the project. Replacement of this culvert will require a wetland permit, although we do not have a preliminary design at this point. Can you please review and provide comment for protection of the species that we may incorporate into the design plans.

Let me know if you have any additional questions. Thanks!

Arin Mills
Environmental Manager, Operations Management
NH Department of Transportation
Bureau of Environment
7 Hazen Drive, Concord, NH 03302
Ph: (603)271-0187
Arin.mills@dot.nh.gov



United States Department of the Interior



FISH AND WILDLIFE SERVICE
New England Ecological Services Field Office
70 Commercial Street, Suite 300
Concord, NH 03301-5094
Phone: (603) 223-2541 Fax: (603) 223-0104
<http://www.fws.gov/newengland>

In Reply Refer To:

May 30, 2019

Consultation Code: 05E1NE00-2019-SLI-1838

Event Code: 05E1NE00-2019-E-04536

Project Name: Northwood, 42363

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

<http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF>

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (<http://www.fws.gov/windenergy/>) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: <http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm>; <http://www.towerkill.com>; and <http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html>.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

New England Ecological Services Field Office
70 Commercial Street, Suite 300
Concord, NH 03301-5094
(603) 223-2541

Project Summary

Consultation Code: 05E1NE00-2019-SLI-1838

Event Code: 05E1NE00-2019-E-04536

Project Name: Northwood, 42363

Project Type: TRANSPORTATION

Project Description: Replace a 5' high b 7' wide cmp arch pipe carrying an un-named tributary (perennial stream) of Narrows Brook under NH 107. Incidental work includes replacement of a 12" cmp closed drainage pipe at culvert outlet and construction of short runs of new guardrail on both sides of NH 107.

Project Location:

Approximate location of the project can be viewed in Google Maps: <https://www.google.com/maps/place/43.22976103564225N71.24732873541329W>



Counties: Rockingham, NH

Endangered Species Act Species

There is a total of 2 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries¹, as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

-
1. [NOAA Fisheries](#), also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Mammals

NAME	STATUS
Northern Long-eared Bat <i>Myotis septentrionalis</i> No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9045	Threatened

Flowering Plants

NAME	STATUS
Small Whorled Pogonia <i>Isotria medeoloides</i> No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/1890	Threatened

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.



United States Department of the Interior



FISH AND WILDLIFE SERVICE
New England Ecological Services Field Office
70 Commercial Street, Suite 300
Concord, NH 03301-5094
Phone: (603) 223-2541 Fax: (603) 223-0104
<http://www.fws.gov/newengland>

In Reply Refer To:

May 30, 2019

Consultation Code: 05E1NE00-2019-TA-1838

Event Code: 05E1NE00-2019-E-04539

Project Name: Northwood, 42363

Subject: Verification letter for the 'Northwood, 42363' project under the January 5, 2016, Programmatic Biological Opinion on Final 4(d) Rule for the Northern Long-eared Bat and Activities Excepted from Take Prohibitions.

Dear Arin Mills:

The U.S. Fish and Wildlife Service (Service) received on May 30, 2019 your effects determination for the 'Northwood, 42363' (the Action) using the northern long-eared bat (*Myotis septentrionalis*) key within the Information for Planning and Consultation (IPaC) system. This IPaC key assists users in determining whether a Federal action is consistent with the activities analyzed in the Service's January 5, 2016, Programmatic Biological Opinion (PBO). The PBO addresses activities excepted from "take"^[1] prohibitions applicable to the northern long-eared bat under the Endangered Species Act of 1973 (ESA) (87 Stat.884, as amended; 16 U.S.C. 1531 et seq.).

Based upon your IPaC submission, the Action is consistent with activities analyzed in the PBO. The Action may affect the northern long-eared bat; however, any take that may occur as a result of the Action is not prohibited under the ESA Section 4(d) rule adopted for this species at 50 CFR §17.40(o). Unless the Service advises you within 30 days of the date of this letter that your IPaC-assisted determination was incorrect, this letter verifies that the PBO satisfies and concludes your responsibilities for this Action under ESA Section 7(a)(2) with respect to the northern long-eared bat.

Please report to our office any changes to the information about the Action that you submitted in IPaC, the results of any bat surveys conducted in the Action area, and any dead, injured, or sick northern long-eared bats that are found during Action implementation. If the Action is not completed within one year of the date of this letter, you must update and resubmit the information required in the IPaC key.

This IPaC-assisted determination allows you to rely on the PBO for compliance with ESA Section 7(a)(2) only for the northern long-eared bat. It **does not** apply to the following ESA-protected species that also may occur in the Action area:

- Small Whorled Pogonia, *Isotria medeoloides* (Threatened)

If the Action may affect other federally listed species besides the northern long-eared bat, a proposed species, and/or designated critical habitat, additional consultation between you and this Service office is required. If the Action may disturb bald or golden eagles, additional coordination with the Service under the Bald and Golden Eagle Protection Act is recommended.

[1]Take means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct [ESA Section 3(19)].

Action Description

You provided to IPaC the following name and description for the subject Action.

1. Name

Northwood, 42363

2. Description

The following description was provided for the project 'Northwood, 42363':

Replace a 5' high b 7' wide cmp arch pipe carrying an un-named tributary (perennial stream) of Narrows Brook under NH 107. Incidental work includes replacement of a 12" cmp closed drainage pipe at culvert outlet and construction of short runs of new guardrail on both sides of NH 107.

Approximate location of the project can be viewed in Google Maps: <https://www.google.com/maps/place/43.22976103564225N71.24732873541329W>

**Determination Key Result**

This Federal Action may affect the northern long-eared bat in a manner consistent with the description of activities addressed by the Service's PBO dated January 5, 2016. Any taking that may occur incidental to this Action is not prohibited under the final 4(d) rule at 50 CFR §17.40(o). Therefore, the PBO satisfies your responsibilities for this Action under ESA Section 7(a)(2) relative to the northern long-eared bat.

Determination Key Description: Northern Long-eared Bat 4(d) Rule

This key was last updated in IPaC on May 15, 2017. Keys are subject to periodic revision.

This key is intended for actions that may affect the threatened northern long-eared bat.

The purpose of the key for Federal actions is to assist determinations as to whether proposed actions are consistent with those analyzed in the Service's PBO dated January 5, 2016.

Federal actions that may cause prohibited take of northern long-eared bats, affect ESA-listed species other than the northern long-eared bat, or affect any designated critical habitat, require ESA Section 7(a)(2) consultation in addition to the use of this key. Federal actions that may affect species proposed for listing or critical habitat proposed for designation may require a conference under ESA Section 7(a)(4).

Determination Key Result

This project may affect the threatened Northern long-eared bat; therefore, consultation with the Service pursuant to Section 7(a)(2) of the Endangered Species Act of 1973 (87 Stat.884, as amended; 16 U.S.C. 1531 et seq.) is required. However, based on the information you provided, this project may rely on the Service's January 5, 2016, *Programmatic Biological Opinion on Final 4(d) Rule for the Northern Long-Eared Bat and Activities Excepted from Take Prohibitions* to fulfill its Section 7(a)(2) consultation obligation.

Qualification Interview

1. Is the action authorized, funded, or being carried out by a Federal agency?

Yes

2. Have you determined that the proposed action will have "no effect" on the northern long-eared bat? (If you are unsure select "No")

No

3. Will your activity purposefully **Take** northern long-eared bats?

No

4. Is the project action area located wholly outside the White-nose Syndrome Zone?

Automatically answered

No

5. Have you contacted the appropriate agency to determine if your project is near a known hibernaculum or maternity roost tree?

Location information for northern long-eared bat hibernacula is generally kept in state Natural Heritage Inventory databases – the availability of this data varies state-by-state. Many states provide online access to their data, either directly by providing maps or by providing the opportunity to make a data request. In some cases, to protect those resources, access to the information may be limited. A web page with links to state Natural Heritage Inventory databases is available at www.fws.gov/midwest/endangered/mammals/nleb/nhisites.html.

Yes

6. Will the action affect a cave or mine where northern long-eared bats are known to hibernate (i.e., hibernaculum) or could it alter the entrance or the environment (physical or other alteration) of a hibernaculum?

No

7. Will the action involve Tree Removal?

Yes

8. Will the action only remove hazardous trees for the protection of human life or property?

No

9. Will the action remove trees within 0.25 miles of a known northern long-eared bat hibernaculum at any time of year?

No

10. Will the action remove a known occupied northern long-eared bat maternity roost tree or any trees within 150 feet of a known occupied maternity roost tree from June 1 through July 31?

No

Project Questionnaire

If the project includes forest conversion, report the appropriate acreages below. Otherwise, type '0' in questions 1-3.

1. Estimated total acres of forest conversion:

.01

2. If known, estimated acres of forest conversion from April 1 to October 31

.01

3. If known, estimated acres of forest conversion from June 1 to July 31

.01

If the project includes timber harvest, report the appropriate acreages below. Otherwise, type '0' in questions 4-6.

4. Estimated total acres of timber harvest

0

5. If known, estimated acres of timber harvest from April 1 to October 31

0

6. If known, estimated acres of timber harvest from June 1 to July 31

0

If the project includes prescribed fire, report the appropriate acreages below. Otherwise, type '0' in questions 7-9.

7. Estimated total acres of prescribed fire

0

8. If known, estimated acres of prescribed fire from April 1 to October 31

0

9. If known, estimated acres of prescribed fire from June 1 to July 31

0

If the project includes new wind turbines, report the megawatts of wind capacity below. Otherwise, type '0' in question 10.

10. What is the estimated wind capacity (in megawatts) of the new turbine(s)?

0

Project Northwood 42363

NHDOT Cultural Resources Review

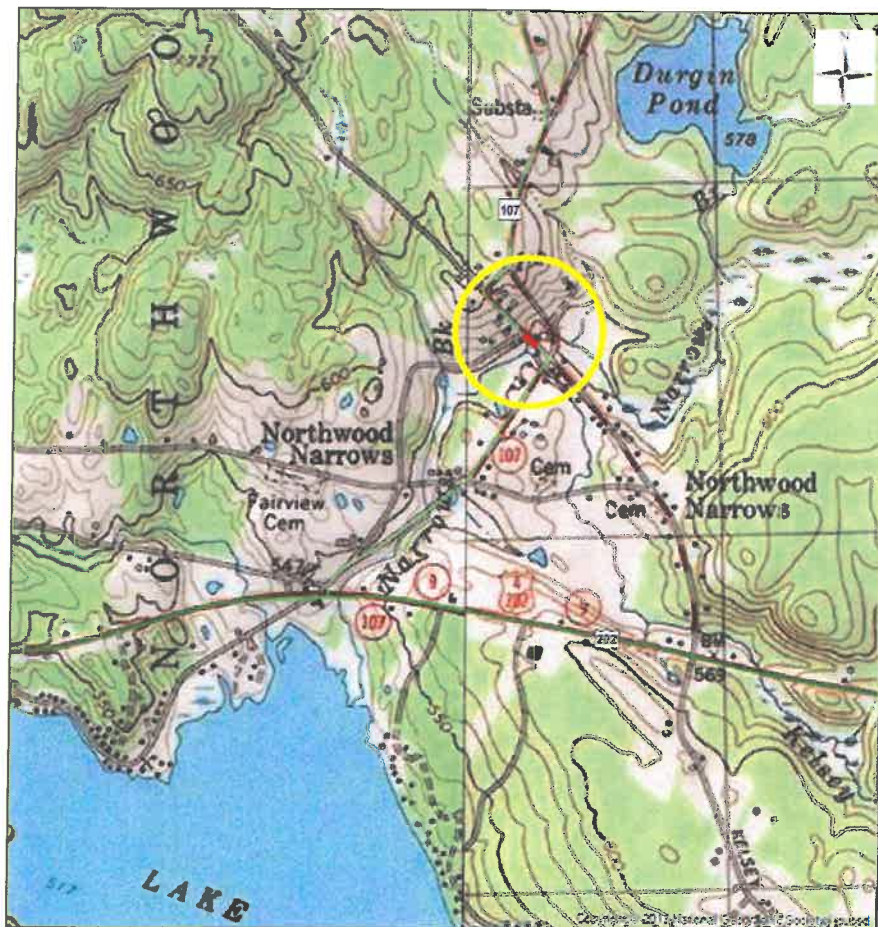
For the purpose of compliance with regulations of the National Historic Preservation Act, the Advisory Council on Historic Preservation's *Procedures for the Protection of Historic Properties* (36 CFR 800), the US Army Corps of Engineers' *Appendix C*, and/or state regulation RSA 227-C:9, *Directive for Cooperation in the Protection of Historic Resources*, the NHDOT Cultural Resources Program has reviewed the proposed project for potential impacts to historic properties.

PROJECT PROPOSAL: State funded project that proposes:

- replacement of an embedded 5' high by 7' wide corrugated metal arch pipe carrying NH 107 (Main Street) over Narrows (aka Mill) Brook, a perennial stream. The project area is located approximately 230' NW of High St. Headwalls on both the inlet and outlet consist of large placed stones which line approximately 10' of the stream channel bank. The stream completely overtops the road during flood events.
- replacement of a 12" cmp closed drainage pipe at the culvert outlet that connects to a catch basin 75' northwest along NH RT 107
- replacement of guardrail on both sides of the road
- resurfacing of approximately 150' including one driveway cut.

NHDOT Bureau of Environment Arin Mills and Matt Urban, in conjunction with NHDOT District XXXX Ralph Sanders, conducted a field review on February 21, 2019.

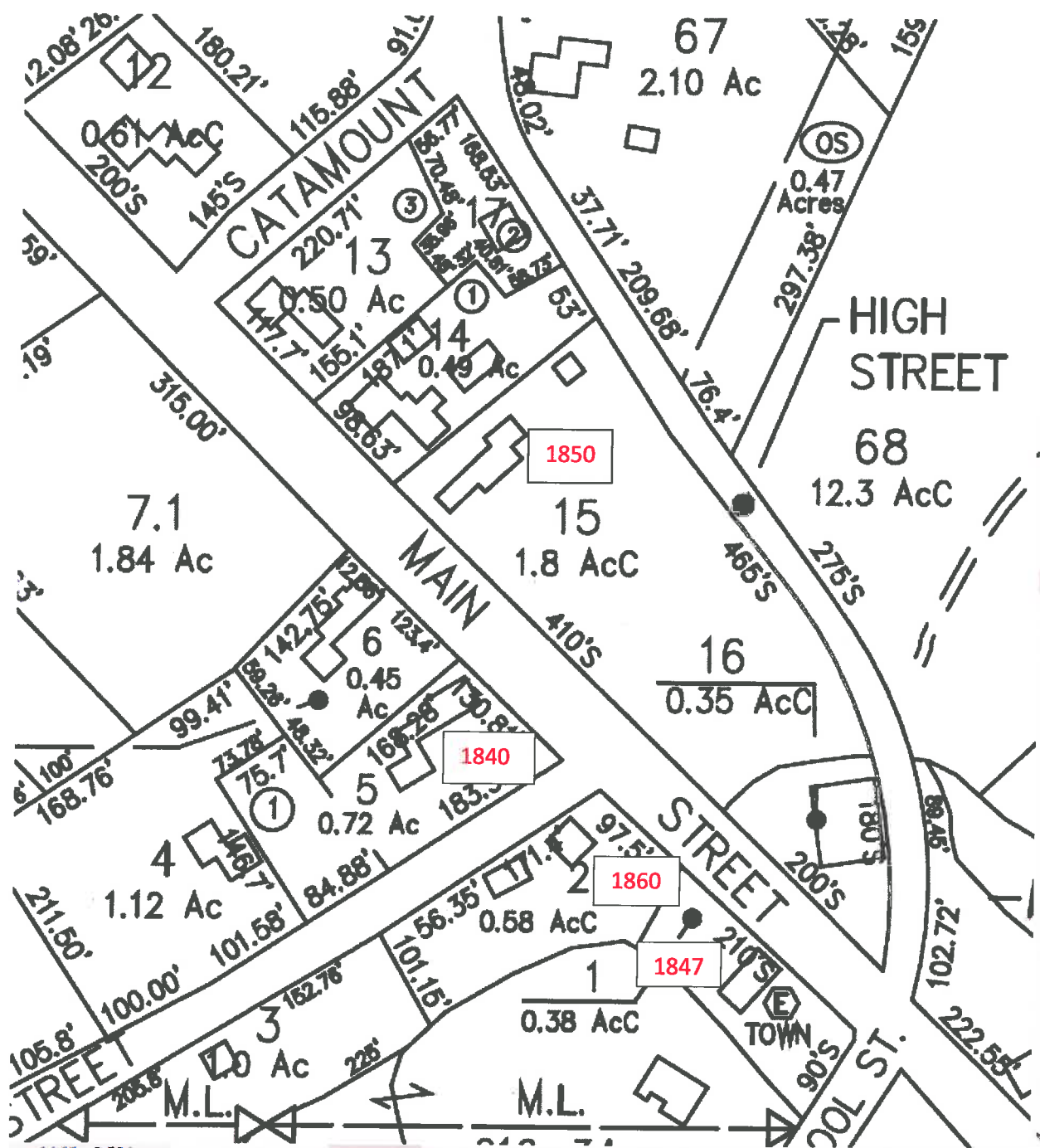
Northwood, #42363



Legend
— Project Boundary
— US Routes
— State Routes

Map depicting culvert replacement project #42363.
317508.33 easting, 4788777.47 northing
Map created by Arin Mills on 1/18/2019
Source: S:\Environment\PROJECTS\NORTHWOOD\42363





Above Ground Review

Known/approximate age of structures:

Although the culvert and adjacent properties are not listed on the National Register of Historic Places, the project area lies within the **Northwood Narrows Historic District**, which was deemed eligible for listing on the National Register of Historic Places in 1994.

The Northwood Narrows Historic District is significant primarily under Criteria A for settlement and commerce as it represents the evolution of the village from its earliest settlement [1763] through period of agricultural expansion growth of the village, both as a population and civic center, and the influence of the shoe industry in rural New Hampshire.

This above ground review summarizes the standing structures and associated parcels in the APE of the project area. Standing structures in the APE were previously surveyed as part of the Northwood Narrows Historic District in 1991. All were identified as primary or secondary contributing properties within the historic district, except for the commercial structure southeast of the culvert crossing, which was described as "new" in 1994.

Corrugated Metal Pipe Culvert

Ralph Sanders ("Sandy") at District indicated he does not have a date for the metal arch pipe culvert. He believes it was a maintenance project with little/no documentation.

Looking west towards CMP culvert and NH RT 107, 2/21/2019



Northeast of the culvert crossing and east of NH 107 (Main Street) is an undeveloped emergent marsh wetland adjacent to the stream, which is part of a larger wetland complex upstream of the crossing Mills 2019).

Northwood Community Hall aka Veterans of Foreign Wars (VFW Post 7217)

The Northwood Community (Union) Hall, aka VFW post, lies southwest of the culvert crossing (Tax Map 212-1; formerly 20D-33; 20d/n.1.). Built c.1880 in the stick style (Hostutler 1991; Inventory #361), the property was identified as a primary contributing property within the Northwood Narrows Historic District. A gravel parking lot surrounds much of the building. South of the standing structure is a bandstand platform and a flag pole, and School Street.

Looking southeast along NH-107 at culvert crossing location, Google Map Street View 2013



Looking Southwest along NH 107 (Main Street) at culvert crossing location & Community Hall, Google Map street view 2013



Looking west and then southeast at Community Hall, 2/21/2019



Looking northwest, Google Street View, 2013



C.R. Towle House at 139 Main Street

The C.R. Towle House at 139 Main Street lies northwest of the culvert crossing (Tax Map 212-2; formerly 20D-31; 20d/n.1.). Built c.1870 (Hostutler 1991; Inventory #360), the single family residence property was identified as containing a primary contributing structure and secondary non-contributing structure (the detached garage) within the Northwood Narrows Historic District.

Two driveways lead onto the property from the road. The southeast end of the northern most driveway at the edge of the road pavement contains a catch basin. The drainage pipe leading from the catch basin to the culvert runs along the west side of Main Street and extends directly in front of this property. During the field review on 2/21/2019, an individual in the driveway expressed concerns for the need to cut the large Maple tree in the front lawn between the residence and the existing catch basin. Follow up is needed for this property owner concern.

Looking northwest, Google Map street view 2013



Looking northwest, 2/21/2019



Looking southwest, 2/21/2019



Alonzo J. Fogg House at 151 Main Street

To the north of the culvert crossing and West Street and on the west side of Main Street (NH 107) is the Alonzo J. Fogg House at 151 Main Street (Tax Map 212-5; formerly 20D-27). Built c.1850 (Hostutler 1991; Inventory #359), the single family property was identified as containing a primary contributing structure (Greek Revival residence) within the Northwood Narrows Historic District.

George C. Lancaster House at 152 Main Street

To the north of the culvert crossing and West Street and on the east side of Main Street (NH 107) is the George C. Lancaster House at 152 Main Street (Tax Map 212-15; formerly 20D-24). Built c.1850 (Hostutler 1991; Inventory #357), the single family property was identified as containing a primary contributing structure (Greek Revival residence) and 3 secondary contributing structures within the Northwood Narrows Historic District.

Commercial Property at 132 Main Street

To the southeast of the culvert crossing on the east side of Main Street (NH 107) and north of High/School Street is a property with one commercial building and an associated gravel parking lot (Tax Map 212-16; formerly 20D-34). The 1994, Northwood Narrows Historic District Area Form map referred to this as a "new" and non-contributing post-1950 commercial property within the Northwood Narrows Historic District. Tax records associate the building with True Design, Inc. A chain link fence runs parallel to the east side of NH RT 107 and is skewed to the stream bank. The fence will likely need to be removed and/or relocated to complete the culvert replacement. The mounded area as seen in the google view was not apparent during the field review on 2/21/2019.

Looking northeast along NH-107, Google Map Street View 2013



Looking southeast at culvert outlet, Google Map street view 2013



Looking southeast, 2/21/2019



☒ **No Potential to Cause Effect/No Concerns**

The modern culvert and modern guardrail have already been introduced to the historic district setting. There are no concerns replacing the culvert or guardrail, as long as impacts remain minimized. The guardrail extension lengths should be limited as much as possible.

☐ **Concerns:**

Below Ground ReviewRecorded Archaeological site: ☐ Yes ☒ No

Nearest Recorded Archaeological Site Name & Number: 27-RK-0025 Joshua Hoitts Grist Mill

☐ Pre-Contact ☒ Post-Contact

Distance from Project Area:

2330 ft 710 meters) southwest of project area

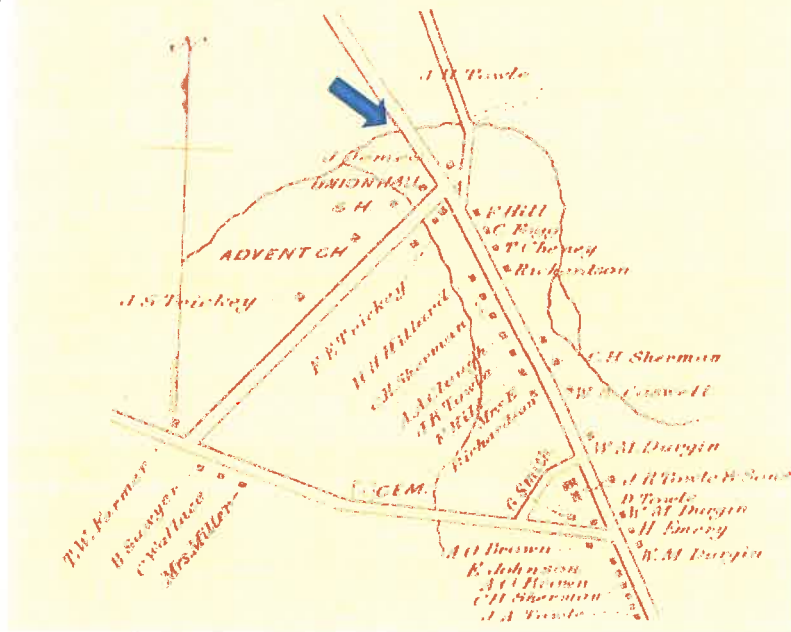
☒ No Potential to Cause Effect/No Concerns

The proposed project locations were reviewed to determine if there are known archaeological sites in or immediately adjacent; there are none.

Cartographic Research was conducted. The 1892 Hurd and 1857 Chace map do not depict any structures directly in the culvert project area.

In the southwest quadrant of the project area, the 1892 Hurd map depicts Community Town (Union) Hall, now the VFW building, is situated. The 1857 Chace map depicts a shoe shop in this vicinity.

In the southeast quadrant of the project area at the northeast corner of the Main Street intersection with School Street/High Street, the 1892 Hurd and 1857 Chace maps depict a school house.

1892 Hurd Map of Northwood Narrows**NORTHWOOD NARROWS
P.O.****TOWN OF NORTHWOOD**

1857 J. Chace Map



As long as the actions remain within the disturbed footprint, there are no concerns.
If the alignment changes or the replacement impacts expand, additional review will be needed.

☐ **Concerns:**

Reviewed by:

Theresa Charles

3/8/2019

NHDOT Cultural Resources Staff

Date:



**US Army Corps
of Engineers®**
New England District

Appendix B

Regional General Permits (GPs) Required Information and Corps Secondary Impacts Checklist

In order for the Corps of Engineers to properly evaluate your application, applicants must submit the following information along with the New Hampshire DES Wetlands Bureau application or permit notification forms. Some projects may require more information. For a more comprehensive checklist, go to www.nae.usace.army.mil/regulatory, “Forms/Publications” and then “Application and Plan Guideline Checklist.” Check with the Corps at (978) 318-8832 for project-specific requirements. For your convenience, this Appendix B is also attached to the State of New Hampshire DES Wetlands Bureau application and Permit by Notification forms.

All Projects:

- Corps application form (**ENG Form 4345**) as appropriate.
- Photographs of wetland/waterway to be impacted.
- Purpose of the project.
- Legible, reproducible black and white (no color) plans no larger than 11”x17” with bar scale. Provide locus map and plan views of the entire property.
- Typical cross-section views of all wetland and waterway fill areas and wetland replication areas.
- In navigable waters, show mean low water (MLW) and mean high water (MHW) elevations. Show the high tide line (HTL) elevations when fill is involved. In other waters, show ordinary high water (OHW) elevation.
- On each plan, show the following for the project:
- Vertical datum and the NAVD 1988 equivalent with the vertical units as U.S. feet. Don’t use local datum. In coastal waters this may be mean higher high water (MHHW), mean high water (MHW), mean low water (MLW), mean lower low water (MLLW) or other tidal datum with the vertical units as U.S. feet. MLLW and MHHW are preferred. Provide the correction factor detailing how the vertical datum (e.g., MLLW) was derived using the latest National Tidal Datum Epoch for that area, typically 1983-2001.
- Horizontal state plane coordinates in U.S. survey feet based on the Traverse Mercator Grid system for the State of New Hampshire (Zone 2800) NAD 83.
- Show project limits with existing and proposed conditions.
- Limits of any Federal Navigation Project in the vicinity of the project area and horizontal State Plane Coordinates in U.S. survey feet for the limits of the proposed work closest to the Federal Navigation Project;
- Volume, type, and source of fill material to be discharged into waters and wetlands, including the area(s) (in square feet or acres) of fill in wetlands, below the ordinary high water in inland waters and below the high tide line in coastal waters.
- Delineation of all waterways and wetlands on the project site,;
- Use Federal delineation methods and include Corps wetland delineation data sheets. See GC 2 and www.nero.noaa.gov/hcd for eelgrass survey guidance.
- GP 3, Moorings, contains eelgrass survey requirements for the placement of moorings.
- For activities involving discharges of dredged or fill material into waters of the U.S., include a statement describing how impacts to waters of the U.S. are to be avoided and minimized, and either a statement describing how impacts to waters of the U.S. are to be compensated for (or a conceptual or detailed mitigation plan) or a statement explaining why compensatory mitigation should not be required for the proposed impacts. Please contact the Corps for guidance.



**US Army Corps
of Engineers**
New England District

**New Hampshire General Permits (GPs)
Appendix B - Corps Secondary Impacts Checklist
(for inland wetland/waterway fill projects in New Hampshire)**

1. Attach any explanations to this checklist. Lack of information could delay a Corps permit determination.
2. All references to "work" include all work associated with the project construction and operation. Work includes filling, clearing, flooding, draining, excavation, dozing, stumping, etc.
3. See GC 5, regarding single and complete projects.
4. Contact the Corps at (978) 318-8832 with any questions.

1. Impaired Waters	Yes	No
1.1 Will any work occur within 1 mile upstream in the watershed of an impaired water? See http://des.nh.gov/organization/divisions/water/wmb/section401/impaired_waters.htm to determine if there is an impaired water in the vicinity of your work area.*	X	
2. Wetlands	Yes	No
2.1 Are there are streams, brooks, rivers, ponds, or lakes within 200 feet of any proposed work?	X	
2.2 Are there proposed impacts to SAS, special wetlands. Applicants may obtain information from the NH Department of Resources and Economic Development Natural Heritage Bureau (NHB) DataCheck Tool for information about resources located on the property at https://www2.des.state.nh.us/nhb_datacheck/ . The book Natural Community Systems of New Hampshire also contains specific information about the natural communities found in NH.		
2.3 If wetland crossings are proposed, are they adequately designed to maintain hydrology, sediment transport & wildlife passage?	X	
2.4 Would the project remove part or all of a riparian buffer? (Riparian buffers are lands adjacent to streams where vegetation is strongly influenced by the presence of water. They are often thin lines of vegetation containing native grasses, flowers, shrubs and/or trees that line the stream banks. They are also called vegetated buffer zones.)		X
2.5 The overall project site is more than 40 acres?		X
2.6 What is the area of the previously filled wetlands?	10,000 sf	
2.7 What is the area of the proposed fill in wetlands?	15 SF	
2.8 What is the % of previously and proposed fill in wetlands to the overall project site?	29%	
3. Wildlife	Yes	No
3.1 Has the NHB & USFWS determined that there are known occurrences of rare species, exemplary natural communities, Federal and State threatened and endangered species and habitat, in the vicinity of the proposed project? (All projects require an NHB ID number & a USFWS IPAC determination.) NHB DataCheck Tool: https://www2.des.state.nh.us/nhb_datacheck/ USFWS IPAC website: https://ecos.fws.gov/ipac/location/index	X	

3.2 Would work occur in any area identified as either "Highest Ranked Habitat in N.H." or "Highest Ranked Habitat in Ecological Region"? (These areas are colored magenta and green, respectively, on NH Fish and Game's map, "2010 Highest Ranked Wildlife Habitat by Ecological Condition.") Map information can be found at: • PDF: www.wildlife.state.nh.us/Wildlife/Wildlife_Plan/highest_ranking_habitat.htm . • Data Mapper: www.granit.unh.edu . • GIS: www.granit.unh.edu/data/downloadfreedata/category/databycategory.html .		X
3.3 Would the project impact more than 20 acres of an undeveloped land block (upland, wetland/waterway) on the entire project site and/or on an adjoining property(s)?		X
3.4 Does the project propose more than a 10-lot residential subdivision, or a commercial or industrial development?		X
3.5 Are stream crossings designed in accordance with the GC 21?	X	
4. Flooding/Floodplain Values	Yes	No
4.1 Is the proposed project within the 100-year floodplain of an adjacent river or stream?	X	
4.2 If 4.1 is yes, will compensatory flood storage be provided if the project results in a loss of flood storage?	N/A	
5. Historic/Archaeological Resources		
For a minimum, minor or major impact project - a copy of the Request for Project Review (RPR) Form (www.nh.gov/nhdhr/review) with your DES file number shall be sent to the NH Division of Historical Resources as required on Page 11 GC 8(d) of the GP document**	X	

*Although this checklist utilizes state information, its submittal to the Corps is a Federal requirement.

** If your project is not within Federal jurisdiction, coordination with NH DHR is not required under Federal law.

` Additional information:

2.4 The project will require removal of small trees and brush along the stream banks. Clearing areas are estimated at 450 SF (inlet side) and 350 SF (outlet side). This vegetation is expected reestablish naturally.

2.5 Site area is the area of existing ROW and easements within the project limits.

2.6 The area of previously filled wetlands is not known. The estimate provided is the area of roadway and adjacent private development within 60' of the existing channel.

3.1 NHB review #NHB19-0430 and coordination determined no concerns. USFWS Endangered Species Act Official Species List and review determined consistent with 4(d) Rule for the Northern Long-eared bat and no effect on Small whorled pogonia.

4.2 The outlet side of the culvert is located within a Zone A (100 year floodplain). The project will not result in a substantial change to the existing topography within the 100 year floodplain and no loss of flood storage is anticipated. The project will have no effect on the 100 year water surface elevation within the 100 year floodplain.

5 Cultural resource review determined 'No Potential to Cause Effect' for Above or Below Ground resources.



By NHDOT Bureau of Environment 4/30/2019

Culvert inlet side, looking upstream
Wetland #3 (left), #1 (center), #B1 (right)
Impact Areas A, B, C



By NHDOT Bureau of Highway Design 5/21/2019

Culvert inlet side, looking downstream
Wetland #B1 (left), #1 (center), #3 (right)
Impact Areas D, E, F



By NHDOT Bureau of Environment 4/30/2019

Culvert outlet side, looking upstream
Wetland #B2 (left), #2 (center), #B3 (right)
Impact Areas H, G, L



By NHDOT Bureau of Environment 4/30/2019

Culvert outlet side, looking upstream
Wetland #B2 (left), #2 (center), #B3 (right)
Impact Areas G – L



By NHDOT Bureau of Highway Design 7/17/2019
 Culvert outlet side, looking upstream
 Showing condition and low flow



By NHDOT Bureau of Environment 4/30/2019
 Culvert inlet side, looking north
 Wetland #3 (left & center), #1 (right)
 Impact Areas A, B

Northwood 42363
CONSTRUCTION SEQUENCE

Typical Construction Sequence

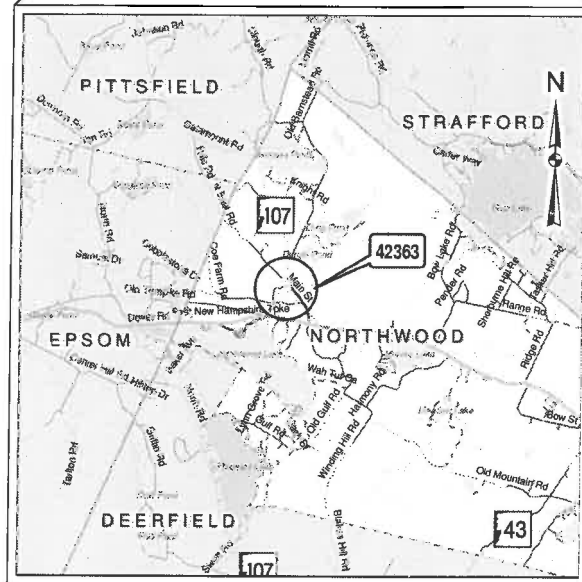
1. Perform necessary clearing operations for access and staging.
2. Install perimeter sediment control and install necessary temporary erosion controls as specified on the strategies. Include all staging areas. Set up dewatering basin.
3. Install Water Diversion (clean water bypass).
4. Set up Phase 1 traffic control barrier (maintain 1 lane of traffic through work area, shifted toward outlet side of culvert).
5. Install Cofferdam (Inlet side of culvert).
6. Installation of approximately half of the box culvert, embedment material, inlet side headwall and wing walls, reconstruct inlet channel and banks.
7. Stabilize inlet channel banks and over bank areas.
8. Set up phase 2 of traffic control (shift traffic toward inlet side of culvert).
9. Modify / Install Cofferdam (to support outlet side of culvert).
10. Install remaining portion of the box culvert, embedment material, outlet side headwall and wing walls, reconstruct inlet channel and banks.
11. Construct closed drainage outlet and proposed catch basin. Connect proposed pipe to existing catch basin and fill and abandon remaining portions of existing 12" cmp closed drainage system.
12. Stabilize outlet channel banks and over bank areas.
13. Remove traffic control barrier (maintain 1 lane of traffic using drums/cones, shift traffic as needed to accomplish remaining operations)
14. Remove diversion pipe, repair and stabilize areas disturbed by removal
15. Stabilize slopes and remaining disturbed areas.
16. Install guardrail and replace pavement
17. Remove all perimeter controls.

STATE OF NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION WETLANDS PLANS BETTERMENT PROJECT

N.H. PROJECT NO. 42363
NH ROUTE 107

DESIGN DATA

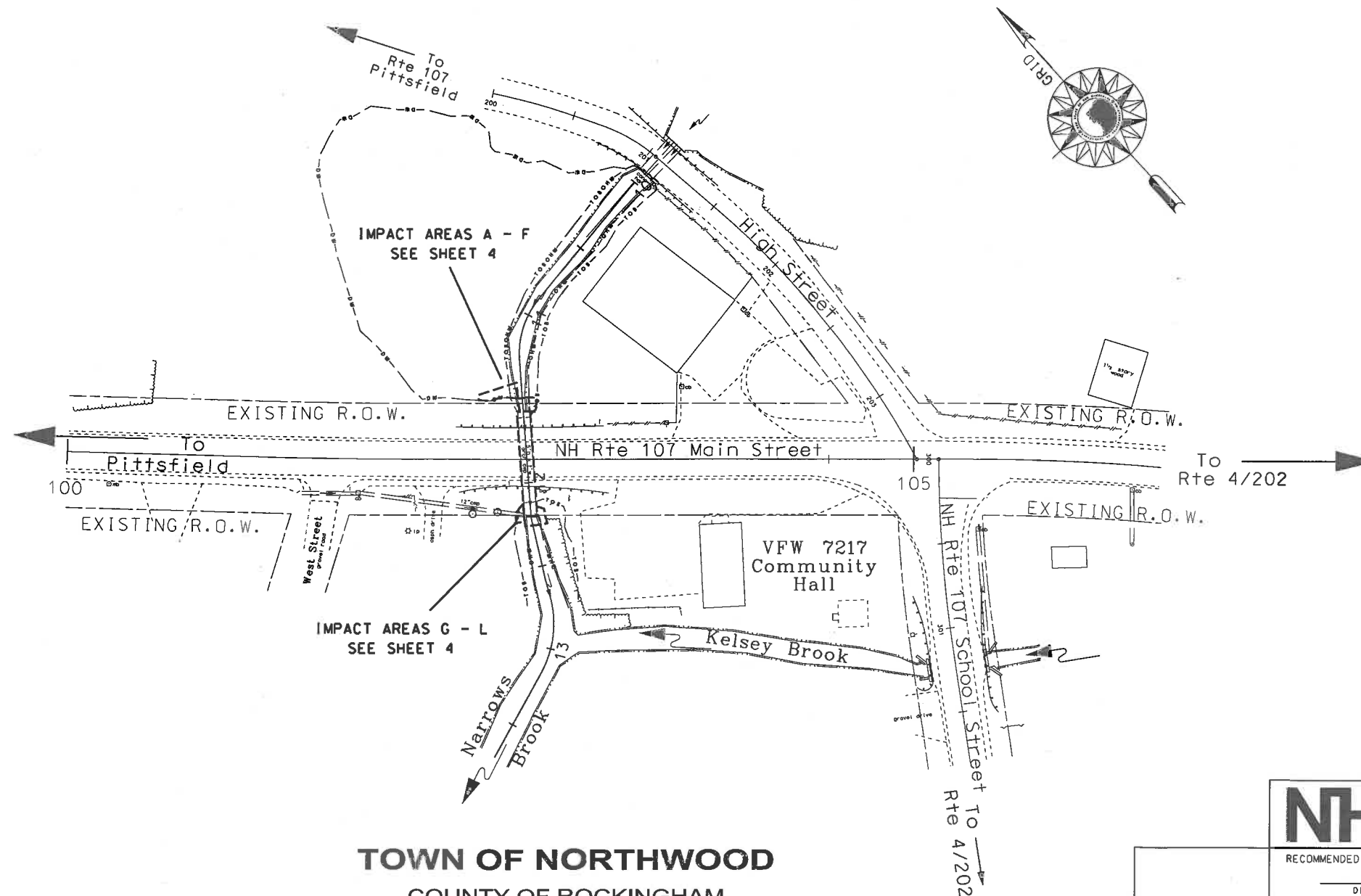
AVERAGE DAILY TRAFFIC 20_18	1,945
AVERAGE DAILY TRAFFIC 20_XX	XX
PERCENT OF TRUCKS	XX
DESIGN SPEED	25 MPH
LENGTH OF PROJECT	200 FT



LOCATION MAP

INDEX OF SHEETS

- 1 FRONT SHEET
- 2-3 STANDARD SYMBOLS SHEETS
- 4 WETLAND IMPACT PLAN
- 5 DETAILS
- 6-7 PROFILES
- 8 EROSION CONTROL STRATEGIES
- 9 EROSION CONTROL PLAN



TOWN OF NORTHWOOD

COUNTY OF ROCKINGHAM

SCALE: 1" = 40'

Wetland Delineation by:
NHDOT (Sarah Large)
May 17, 2019

DATE: 9/11/2019

NHDOT THE STATE OF
NEW HAMPSHIRE
DEPARTMENT OF
TRANSPORTATION

RECOMMENDED FOR APPROVAL:

DIRECTOR OF PROJECT DEVELOPMENT

DATE

APPROVED:

ASSISTANT COMMISSIONER AND CHIEF ENGINEER

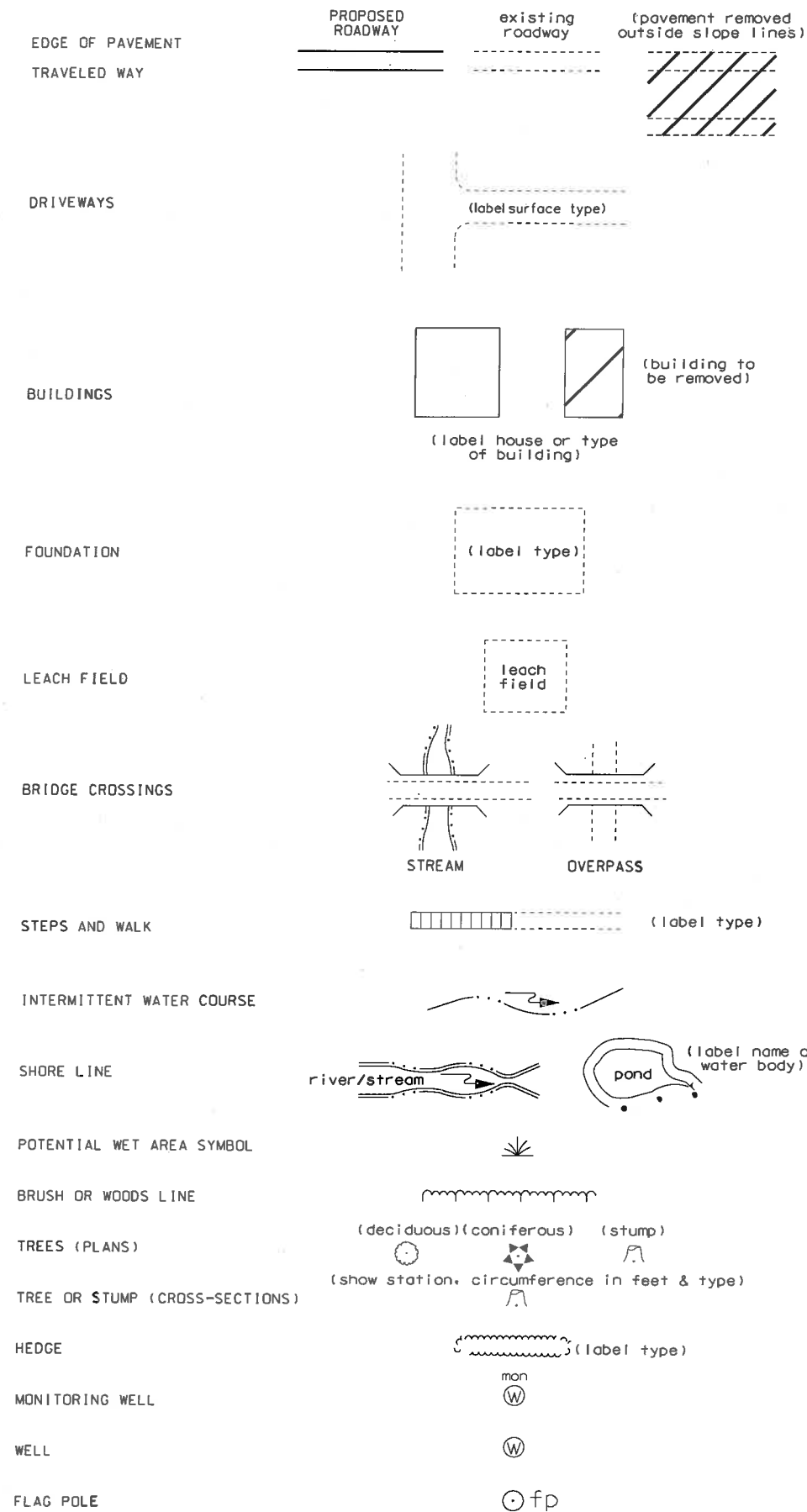
DATE

DRAWING NAME	FEDERAL PROJECT NO.	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
42363fsw		42363	1	9

FOR CONSTRUCTION AND ALIGNMENT DETAILS - SEE CONSTRUCTION PLANS

DRAWN BY: JUN 7/2019
CHECKED BY: CAC DATE: 9/5/19

GENERAL



ORIGINAL GROUND (TYPICALS)

ROCK OUTCROP

ROCK LINE (TYPICALS & SECTIONS ONLY)

GUARDRAIL (label type)

JERSEY BARRIER

CURB (LABEL TYPE)

STONE WALL

RETAINING WALL (LABEL TYPE)

FENCE (LABEL TYPE)

SIGNS

GAS PUMP

FUEL TANK (ABOVE GROUND)

STORAGE TANK FILLER CAP

SEPTIC TANK

GRAVE

MAILBOX

VENT PIPE

SATELLITE DISH ANTENNA

PHONE

GROUND LIGHT/LAMP POST

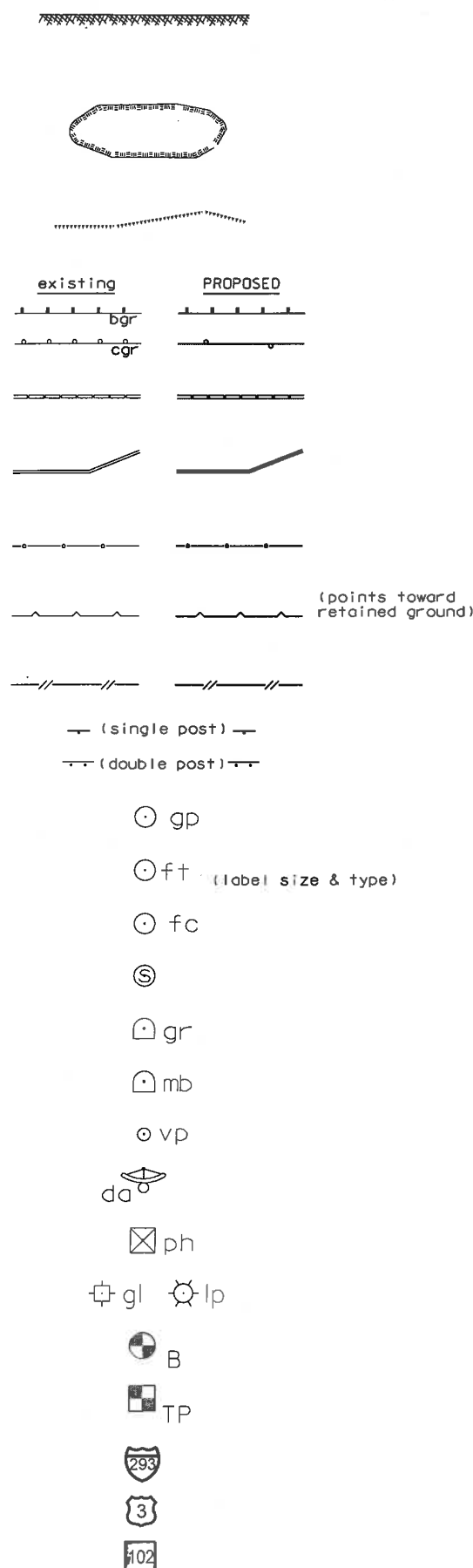
BORING LOCATION

TEST PIT

INTERSTATE NUMBERED HIGHWAY

UNITED STATES NUMBERED HIGHWAY

STATE NUMBERED HIGHWAY



SHORELAND - WETLAND

WETLAND DESIGNATION AND TYPE

DELINEATED WETLAND

ORDINARY HIGH WATER

TOP OF BANK

TOP OF BANK & ORDINARY HIGH WATER

NORMAL HIGH WATER

WIDTH AT BANK FULL

PRIME WETLAND

PRIME WETLAND 100' BUFFER

NON-JURISDICTIONAL DRAINAGE AREA

COWARDIN DISTINCTION LINE

TIDAL BUFFER ZONE

DEVELOPED TIDAL BUFFER ZONE

HIGHEST OBSERVABLE TIDE LINE

MEAN HIGH WATER

MEAN LOW WATER

VERNAL POOL

SPECIAL AQUATIC SITE

REFERENCE LINE

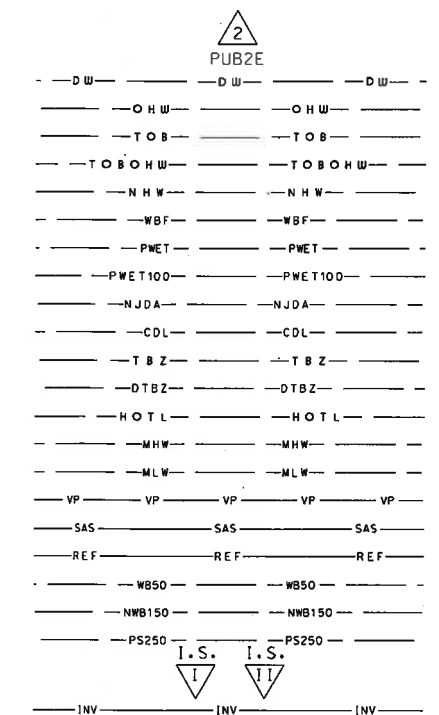
WATER FRONT BUFFER

NATURAL WOODLAND BUFFER

PROTECTED SHORELAND

INVASIVE SPECIES LABEL

INVASIVE SPECIES



FLOODPLAIN / FLOODWAY

500 YEAR FLOODPLAIN BOUNDARY

100 YEAR FLOODPLAIN BOUNDARY

FLOODWAY

FP500

FP100

FW

ENGINEERING

CONSTRUCTION BASELINE

PC, PT, POT (ON CONST BASELINE)

PI (IN CONSTRUCTION BASELINES)

INTERSECTION OR EQUATION OF TWO LINES

ORIGINAL GROUND LINE (PROFILES AND CROSS-SECTIONS)

PROFILE GRADE LINE (PROFILES AND CROSS-SECTIONS)

CLEARING LINE

SLOPE LINE

SLOPE LINE (FILL)

SLOPE LINE (CUT)

PROFILES AND CROSS SECTIONS:

ORIGINAL GROUND ELEVATION (LEFT)

FINISHED GRADE ELEVATION (RIGHT)

72.5

79.14

SHEET 1 OF 2

STATE OF NEW HAMPSHIRE NORTHWOOD				
DEPARTMENT OF TRANSPORTATION • BUREAU OF HIGHWAY DESIGN				
STANDARD SYMBOLS				
REVISION DATE	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
11-21-2014	std symb	42363	2	9

SDR PROCESSED
NEW DESIGN
SHEET CHECKED
AS BUILT DETAILS

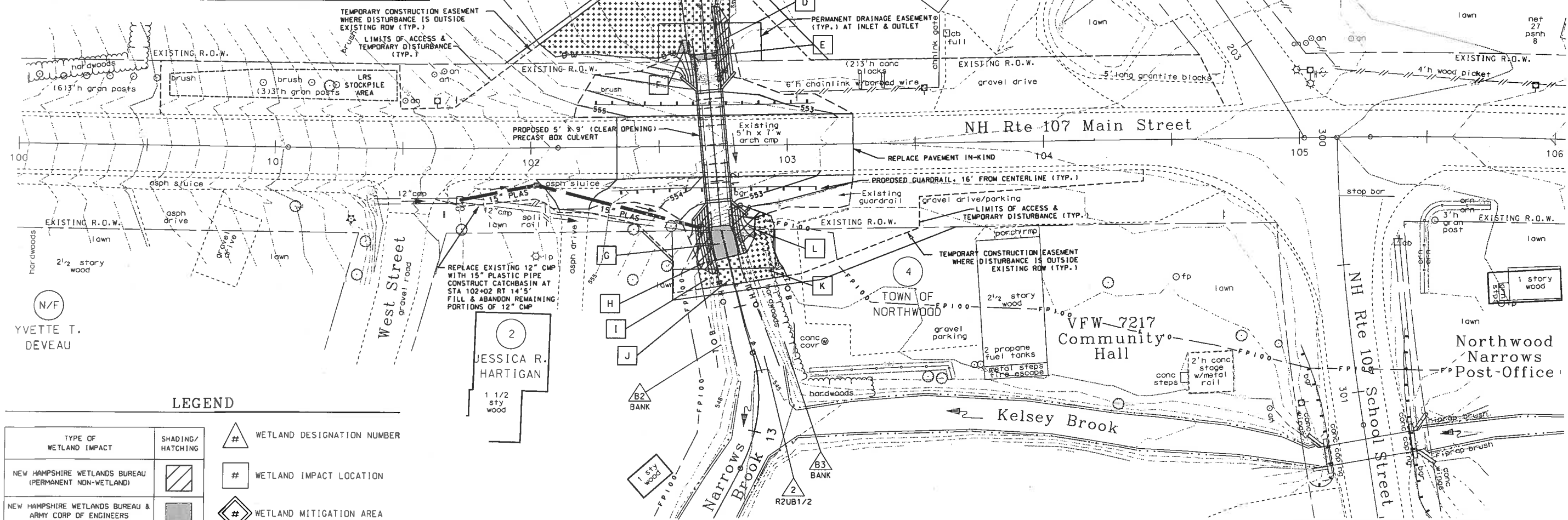
DATE 7/2019
DATE 9/11/19

JUN
CAC

WETLAND IMPACT SUMMARY											
WETLAND NUMBER	WETLAND CLASSIFICATION	LOCATION	AREA IMPACTS						LINEAR STREAM IMPACTS FOR MITIGATION		
			PERMANENT				TEMPORARY		PERMANENT		
			N.H.W.B (NON-WETLAND)		N.H.W.B & A.C.O.E. (WETLAND)				BANK LEFT	BANK RIGHT	CHANNE
			SF	LF	SF	LF	SF	LF	LF	LF	LF
3	PEM1E	A					1,207				
1	R2UB1/2	B					362	60			
B1	BANK	C					63	18			
B1	BANK	D	119	30							
1	R2UB1/2	E		2	18	2					
3	PEM1E	F			15						
2	R2UB1/2	G			111	13					
B2	BANK	H	113	24							
B2	BANK	I					48	12			
2	R2UB1/2	J					102	11			
B3	BANK	K					277	27			
B3	BANK	L	148	18							
SUB-TOTALS			380	74	144	15	2,059	128	0	0	0

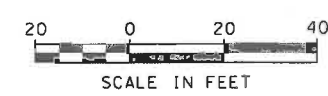
PERMANENT IMPACTS: 524 SF
TEMPORARY IMPACTS: 2,059 SF
TOTAL IMPACTS: 2,583 SF

WETLAND CLASSIFICATION CODES	
R2UB1/2	RIVERINE, LOWER PERENIAL, UNCONSOLIDATED BOTTOM, COBBLE-GRAVEL/SAND
PEM1E	PALUSTRINE, EMERGENT, PERSISTENT, SEASONALLY FLOODED/SATURATED
BANK	BANK

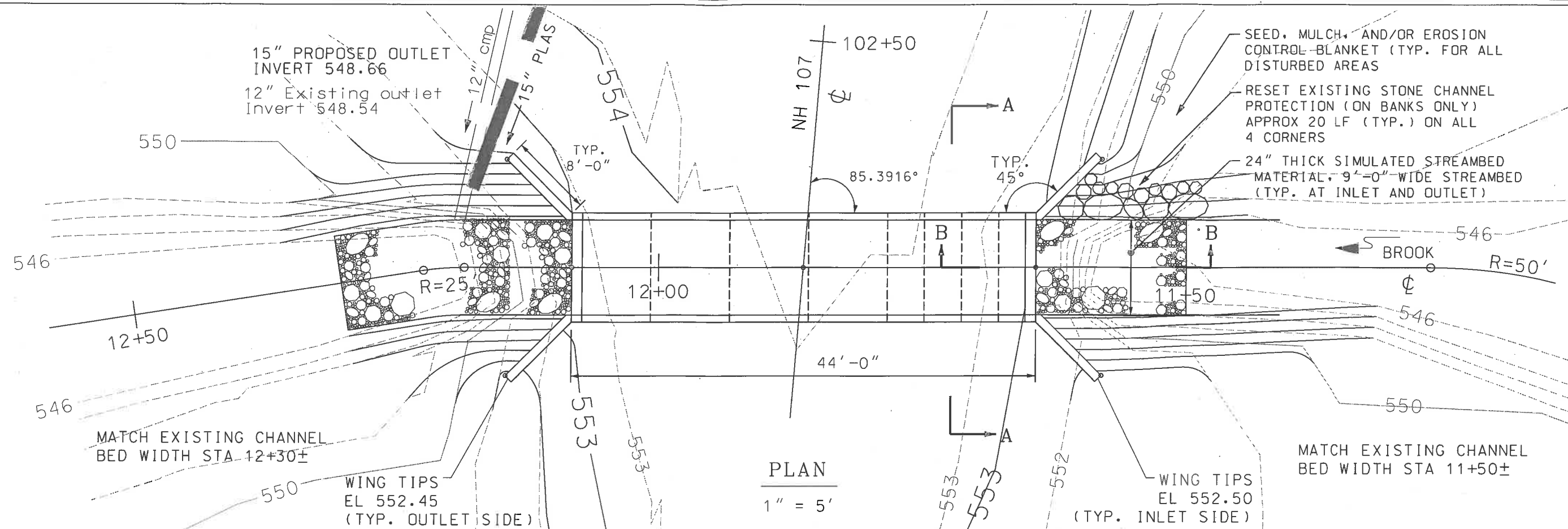


LEGEND	
TYPE OF WETLAND IMPACT	SHADING/HATCHING
NEW HAMPSHIRE WETLANDS BUREAU (PERMANENT NON-WETLAND)	[Hatched Box]
NEW HAMPSHIRE WETLANDS BUREAU & ARMY CORP OF ENGINEERS (PERMANENT WETLAND)	[Solid Grey Box]
TEMPORARY IMPACTS	[Dotted Box]
#	WETLAND DESIGNATION NUMBER
#	WETLAND IMPACT LOCATION
#	WETLAND MITIGATION AREA
[Hatched Box]	MITIGATION

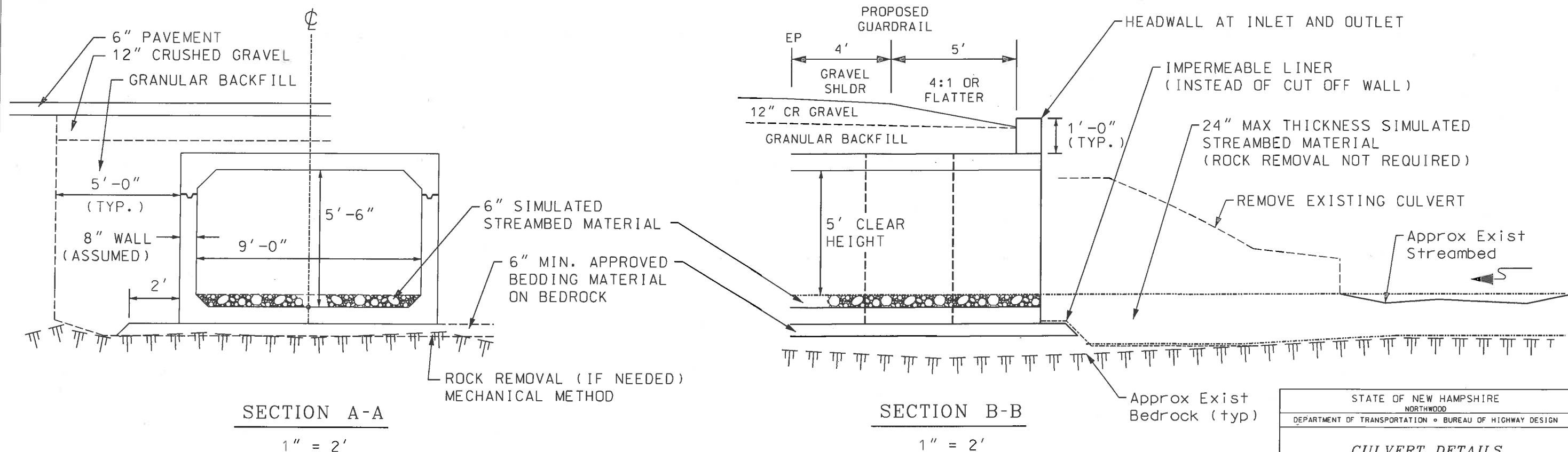
CONTOUR INTERVAL = 1 FOOT



STATE OF NEW HAMPSHIRE NORTHWOOD DEPARTMENT OF TRANSPORTATION • BUREAU OF HIGHWAY DESIGN			
WETLAND IMPACT PLANS			
DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
42363wetplans	42363	4	9

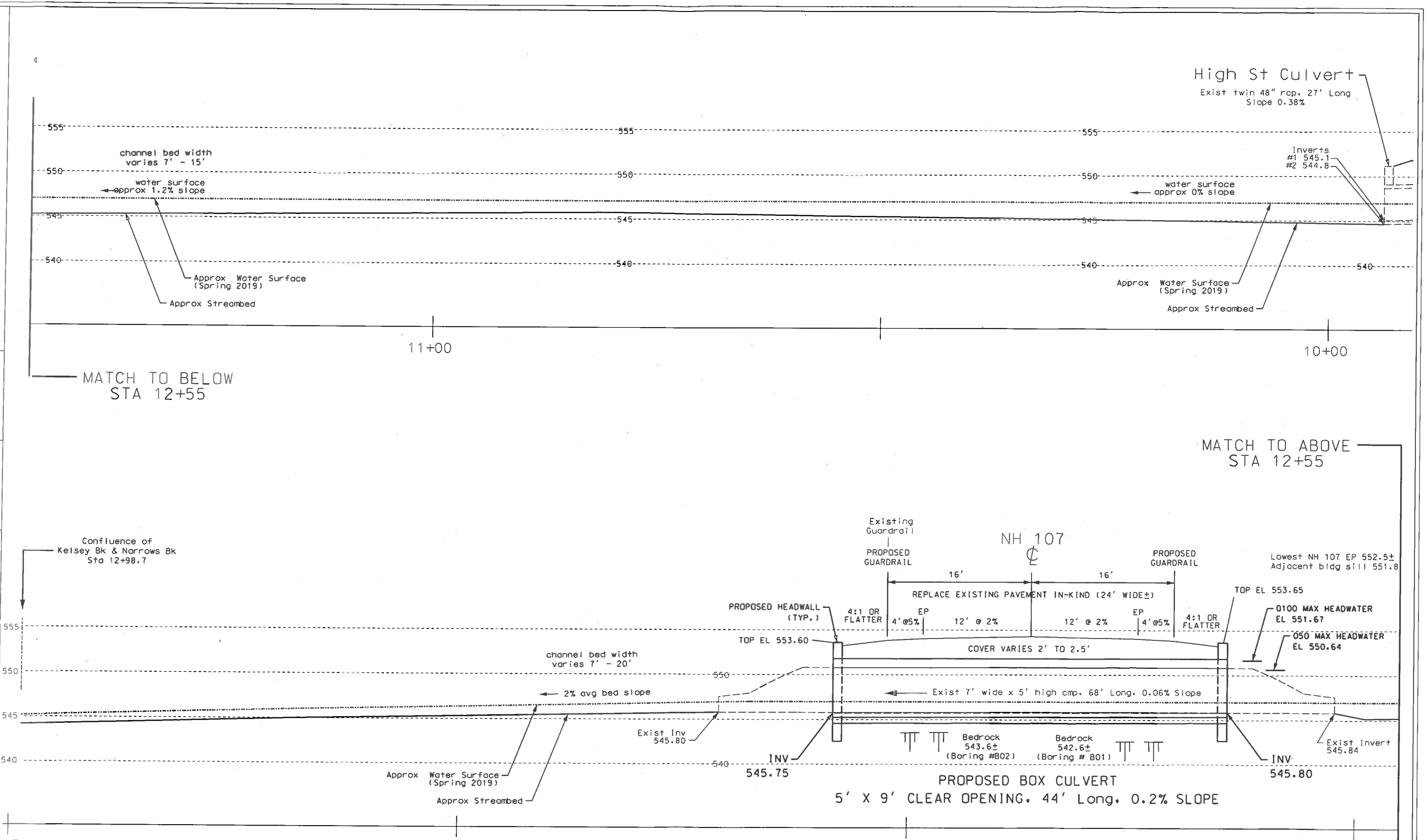
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SEE PROFILES FOR EXISTING AND PROPOSED CULVERT INVERTS

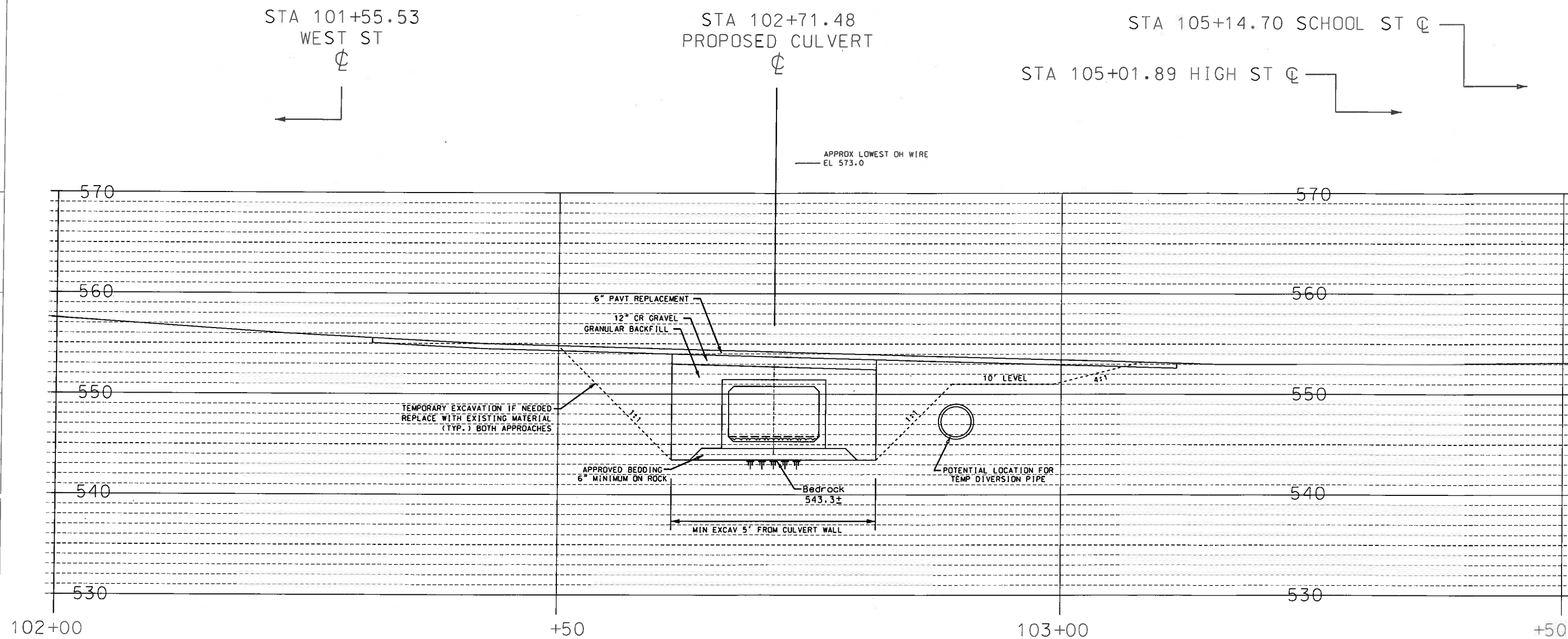


STATE OF NEW HAMPSHIRE			
NORTHWOOD			
DEPARTMENT OF TRANSPORTATION • BUREAU OF HIGHWAY DESIGN			
<i>CULVERT DETAILS</i>			
DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
def_culvert_wetland.plt	2363	5	9

REVISIONS AFTER PROPOSAL		STATION	DATE	NUMBER
SDR PROCESSED				
NEW DESIGN	CAC		7/2019	
SHEET CHECKED	JUN		8/6/19	
AS BUILT DETAILS				



STATE OF NEW HAMPSHIRE NORTHWOOD DEPARTMENT OF TRANSPORTATION • BUREAU OF HIGHWAY DESIGN			
PROFILES			
DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
42363profiles	42363	6	9

[illegible]

NH 107 PROFILE

STATE OF NEW HAMPSHIRE NORTHWOOD			
DEPARTMENT OF TRANSPORTATION • BUREAU OF HIGHWAY DESIGN			
<i>PROFILES</i>			
DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
42363profiles	42363	7	9

EROSION CONTROL STRATEGIES

1. ENVIRONMENTAL COMMITMENTS:
- 1.1. THESE GUIDELINES DO NOT RELIEVE THE CONTRACTOR FROM COMPLIANCE WITH ANY CONTRACT PROVISIONS, OR APPLICABLE FEDERAL, STATE, AND LOCAL REGULATIONS.
- 1.2. THIS PROJECT WILL BE SUBJECT TO THE US EPA'S NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) STORM WATER CONSTRUCTION GENERAL PERMIT AS ADMINISTERED BY THE ENVIRONMENTAL PROTECTION AGENCY (EPA). THIS PROJECT IS SUBJECT TO REQUIREMENTS IN THE MOST RECENT CONSTRUCTION GENERAL PERMIT (CGP).
- 1.3. THE CONTRACTOR'S ATTENTION IS DIRECTED TO THE NHDES WETLAND PERMIT, THE US ARMY CORPS OF ENGINEERS PERMIT, WATER QUALITY CERTIFICATION AND THE SPECIAL ATTENTION ITEMS INCLUDED IN THE CONTRACT DOCUMENTS.
- 1.4. ALL STORM WATER, EROSION AND SEDIMENT CONTROL MEASURES SHALL BE INSTALLED AND MAINTAINED IN ACCORDANCE WITH THE NEW HAMPSHIRE STORMWATER MANUAL, VOLUME 3, EROSION AND SEDIMENT CONTROLS DURING CONSTRUCTION (DECEMBER 2008) (BMP MANUAL) AVAILABLE FROM THE NEW HAMPSHIRE DEPARTMENT OF ENVIRONMENTAL SERVICES (NHDES).
- 1.5. THE CONTRACTOR SHALL COMPLY WITH RSA 485-A:17, AND ALL PUBLISHED NHDES ALTERATION OF TERRAIN ENV-WO 1500 REQUIREMENTS ([HTTP://DES.NH.GOV/ORGANIZATION/COMMISSIONER/LEGAL/RULES/INDEX.HTM](http://des.nh.gov/organization/commissioner/legal/rules/index.htm))
- 1.6. THE CONTRACTOR IS DIRECTED TO REVIEW AND COMPLY WITH SECTION 107.1 OF THE CONTRACT AS IT REFERS TO SPILLAGE, AND ALSO WITH REGARDS TO EROSION, POLLUTION, AND TURBIDITY PRECAUTIONS.
2. STANDARD EROSION CONTROL SEQUENCING APPLICABLE TO ALL CONSTRUCTION PROJECTS:
- 2.1. PERIMETER CONTROLS SHALL BE INSTALLED PRIOR TO EARTH DISTURBING ACTIVITIES. PERIMETER CONTROLS AND STABILIZED CONSTRUCTION EXITS SHALL BE INSTALLED AS SHOWN IN THE BMP MANUAL AND AS DIRECTED BY THE STORMWATER POLLUTION PREVENTION PLAN (SWPPP) PREPARER.
- 2.2. EROSION, SEDIMENTATION CONTROL MEASURES AND INFILTRATION BASINS SHALL BE CLEANED, REPLACED AND AUGMENTED AS NECESSARY TO PREVENT SEDIMENTATION BEYOND PROJECT LIMITS THROUGHOUT THE PROJECT DURATION.
- 2.3. EROSION AND SEDIMENT CONTROL MEASURES SHALL BE INSPECTED IN ACCORDANCE WITH THE CONSTRUCTION GENERAL PERMIT AND SECTION 645 OF THE NHDOT SPECIFICATIONS FOR ROAD AND BRIDGES CONSTRUCTION.
- 2.4. AN AREA SHALL BE CONSIDERED STABLE IF ONE OF THE FOLLOWING HAS OCCURRED:
- (A) BASE COURSE GRAVELS HAVE BEEN INSTALLED IN AREAS TO BE PAVED;
- (B) A MINIMUM OF 85% VEGETATED GROWTH HAS BEEN ESTABLISHED;
- (C) A MINIMUM OF 3" OF NON-EROSIVE MATERIAL SUCH AS STONE OR RIP-RAP HAS BEEN INSTALLED;
- (D) TEMPORARY SLOPE STABILIZATION CONFORMING TO TABLE 1 HAS BEEN PROPERLY INSTALLED
- 2.5. ALL STOCKPILES SHALL BE CONTAINED WITH A PERIMETER CONTROL. IF THE STOCKPILE IS TO REMAIN UNDISTURBED FOR MORE THAN 14 DAYS, MULCHING WILL BE REQUIRED.
- 2.6. A WATER TRUCK SHALL BE AVAILABLE TO CONTROL EXCESSIVE DUST AT THE DIRECTION OF THE CONTRACT ADMINISTRATOR.
- 2.7. TEMPORARY EROSION AND SEDIMENTATION CONTROL MEASURES SHALL REMAIN UNTIL THE AREA HAS BEEN PERMANENTLY STABILIZED.
- 2.8. CONSTRUCTION PERFORMED ANY TIME BETWEEN NOVEMBER 30th AND MAY 1st OF ANY YEAR SHALL BE CONSIDERED WINTER CONSTRUCTION AND SHALL CONFORM TO THE FOLLOWING REQUIREMENTS.
- (A) ALL PROPOSED VEGETATED AREAS WHICH DO NOT EXHIBIT A MINIMUM OF 85% VEGETATIVE GROWTH BY OCTOBER 15th, OR WHICH ARE DISTURBED AFTER OCTOBER 15th, SHALL BE STABILIZED IN ACCORDANCE WITH TABLE 1.
- (B) ALL DITCHES OR SWALES WHICH DO NOT EXHIBIT A MINIMUM OF 85% VEGETATIVE GROWTH BY OCTOBER 15th, OR WHICH ARE DISTURBED AFTER OCTOBER 15th, SHALL BE STABILIZED TEMPORARILY WITH STONE OR IN ACCORDANCE WITH TABLE 1.
- (C) AFTER NOVEMBER 30th INCOMPLETE ROAD SURFACES, WHERE WORK HAS STOPPED FOR THE SEASON, SHALL BE PROTECTED IN ACCORDANCE WITH TABLE 1.
- (D) WINTER EXCAVATION AND EARTHWORK SHALL BE DONE SUCH THAT NO MORE THAN 1 ACRE OF THE PROJECT IS WITHOUT STABILIZATION AT ONE TIME, UNLESS A WINTER CONSTRUCTION PLAN HAS BEEN APPROVED BY NHDOT THAT MEETS THE REQUIREMENTS OF ENV-WO 1505.02 AND ENV-WO 1505.05.
- (E) A SWPPP AMENDMENT SHALL BE SUBMITTED TO THE DEPARTMENT, FOR APPROVAL, ADDRESSING COLD WEATHER STABILIZATION (ENV-WO 1505.05) AND INCLUDING THE REQUIREMENTS OF NO LESS THAN 30 DAYS PRIOR TO THE COMMENCEMENT OF WORK SCHEDULED AFTER NOVEMBER 30th.
- GENERAL CONSTRUCTION PLANNING AND SELECTION OF STRATEGIES TO CONTROL EROSION AND SEDIMENT ON HIGHWAY CONSTRUCTION PROJECTS
3. PLAN ACTIVITIES TO ACCOUNT FOR SENSITIVE SITE CONDITIONS:
- 3.1. CLEARLY FLAG AREAS TO BE PROTECTED IN THE FIELD AND PROVIDE CONSTRUCTION BARRIERS TO PREVENT TRAFFICKING OUTSIDE OF WORK AREAS.
- 3.2. CONSTRUCTION SHALL BE SEQUENCED TO LIMIT THE DURATION AND AREA OF EXPOSED SOILS.
- 3.3. PROTECT AND MAXIMIZE EXISTING NATIVE VEGETATION AND NATURAL FOREST BUFFERS BETWEEN CONSTRUCTION ACTIVITY AND SENSITIVE AREAS.
- 3.4. WHEN WORK IS PERFORMED IN AND NEAR WATER COURSES, STREAM FLOW DIVERSION METHODS SHALL BE IMPLEMENTED PRIOR TO ANY EXCAVATION OR FILLING.
- 3.5. WHEN WORK IS PERFORMED WITHIN 50 FEET OF SURFACE WATERS (WETLAND, OPEN WATER OR FLOWING WATER), PERIMETER CONTROL SHALL BE ENHANCED CONSISTENT WITH SECTION 2.1.2.1. OF THE 2012 NPDES CONSTRUCTION GENERAL PERMIT.
4. MINIMIZE THE AMOUNT OF EXPOSED SOIL:
- 4.1. CONSTRUCTION SHALL BE SEQUENCED TO LIMIT THE DURATION AND AREA OF EXPOSED SOILS. MINIMIZE THE AREA OF EXPOSED SOIL AT ANY ONE TIME. PHASING SHALL BE USED TO REDUCE THE AMOUNT AND DURATION OF SOIL EXPOSED TO THE ELEMENTS AND VEHICLE TRACKING.
- 4.2. UTILIZE TEMPORARY MULCHING OR PROVIDE ALTERNATE TEMPORARY STABILIZATION ON EXPOSED SOILS IN ACCORDANCE WITH TABLE 1.
- 4.3. THE MAXIMUM AMOUNT OF DISTURBED EARTH SHALL NOT EXCEED A TOTAL OF 5 ACRES FROM MAY 1st THROUGH NOVEMBER 30th, OR EXCEED ONE ACRE DURING WINTER MONTHS, UNLESS THE CONTRACTOR DEMONSTRATES TO THE DEPARTMENT THAT THE ADDITIONAL AREA OF DISTURBANCE IS NECESSARY TO MEET THE CONTRACTORS CRITICAL PATH METHOD SCHEDULE (CPM), AND THE CONTRACTOR HAS ADEQUATE RESOURCES AVAILABLE TO ENSURE THAT ENVIRONMENTAL COMMITMENTS WILL BE MET.
5. CONTROL STORMWATER FLOWING ONTO AND THROUGH THE PROJECT:
- 5.1. DIVERT OFF SITE RUNOFF OR CLEAN WATER AWAY FROM THE CONSTRUCTION ACTIVITY TO REDUCE THE VOLUME THAT NEEDS TO BE TREATED ON SITE.
- 5.2. DIVERT STORM RUNOFF FROM UPSLOPE DRAINAGE AREAS AWAY FROM DISTURBED AREAS, SLOPES, AND AROUND ACTIVE WORK AREAS AND TO A STABILIZED OUTLET LOCATION.
- 5.3. CONSTRUCT IMPERMEABLE BARRIERS AS NECESSARY TO COLLECT OR DIVERT CONCENTRATED FLOWS FROM WORK OR DISTURBED AREAS.
- 5.4. STABILIZE, TO APPROPRIATE ANTICIPATED VELOCITIES, CONVEYANCE CHANNELS OR PUMPING SYSTEMS NEEDED TO CONVEY CONSTRUCTION STORMWATER TO BASINS AND DISCHARGE LOCATIONS PRIOR TO USE.
- 5.5. DIVERT OFF-SITE WATER THROUGH THE PROJECT IN AN APPROPRIATE MANNER SO NOT TO DISTURB THE UPSTREAM OR DOWNSTREAM SOILS, VEGETATION OR HYDROLOGY BEYOND THE PERMITTED AREA.
6. PROTECT SLOPES:
- 6.1. INTERCEPT AND DIVERT STORM RUNOFF FROM UPSLOPE DRAINAGE AREAS AWAY FROM UNPROTECTED AND NEWLY ESTABLISHED AREAS AND SLOPES TO A STABILIZED OUTLET OR CONVEYANCE.
- 6.2. CONSIDER HOW GROUNDWATER SEEPAGE ON CUT SLOPES MAY IMPACT SLOPE STABILITY AND INCORPORATE APPROPRIATE MEASURES TO MINIMIZE EROSION.
- 6.3. CONVEY STORMWATER DOWN THE SLOPE IN A STABILIZED CHANNEL OR SLOPE DRAIN.
- 6.4. THE OUTER FACE OF THE FILL SLOPE SHOULD BE IN A LOOSE RUFFLED CONDITION PRIOR TO TURF ESTABLISHMENT. TOPSOIL OR HUMUS LAYERS SHALL BE TRACKED UP AND DOWN THE SLOPE, DISKED, HARROWED, DRAGGED WITH A CHAIN OR MAT, MACHINE-RAKED, OR HAND-WORKED TO PRODUCE A RUFFLED SURFACE.
7. ESTABLISH STABILIZED CONSTRUCTION EXITS:
- 7.1. INSTALL AND MAINTAIN CONSTRUCTION EXITS, ANYWHERE TRAFFIC LEAVES A CONSTRUCTION SITE ONTO A PUBLIC RIGHT-OF-WAY.
- 7.2. SWEEP ALL CONSTRUCTION RELATED DEBRIS AND SOIL FROM THE ADJACENT PAVED ROADWAYS AS NECESSARY.
8. PROTECT STORM DRAIN INLETS:
- 8.1. DIVERT SEDIMENT LADEN WATER AWAY FROM INLET STRUCTURES TO THE EXTENT POSSIBLE.
- 8.2. INSTALL SEDIMENT BARRIERS AND SEDIMENT TRAPS AT INLETS TO PREVENT SEDIMENT FROM ENTERING THE DRAINAGE SYSTEM.
- 8.3. CLEAN CATCH BASINS, DRAINAGE PIPES, AND CULVERTS IF SIGNIFICANT SEDIMENT IS DEPOSITED.
- 8.4. DROP INLET SEDIMENT BARRIERS SHOULD NEVER BE USED AS THE PRIMARY MEANS OF SEDIMENT CONTROL AND SHOULD ONLY BE USED TO PROVIDE AN ADDITIONAL LEVEL OF PROTECTION TO STRUCTURES AND DOWN-GRADIENT SENSITIVE RECEPTORS.
9. SOIL STABILIZATION:
- 9.1. WITHIN THREE DAYS OF THE LAST ACTIVITY IN AN AREA, ALL EXPOSED SOIL AREAS, WHERE CONSTRUCTION ACTIVITIES ARE COMPLETE, SHALL BE STABILIZED.
- 9.2. IN ALL AREAS, TEMPORARY SOIL STABILIZATION MEASURES SHALL BE APPLIED IN ACCORDANCE WITH THE STABILIZATION REQUIREMENTS (SECTION 2.2) OF THE 2012 CGP. (SEE TABLE 1 FOR GUIDANCE ON THE SELECTION OF TEMPORARY SOIL STABILIZATION MEASURES.)
- 9.3. EROSION CONTROL SEED MIX SHALL BE SOWN IN ALL INACTIVE CONSTRUCTION AREAS THAT WILL NOT BE PERMANENTLY SEEDED WITHIN TWO WEEKS OF DISTURBANCE AND PRIOR TO SEPTEMBER 15, OF ANY GIVEN YEAR, IN ORDER TO ACHIEVE VEGETATIVE STABILIZATION PRIOR TO THE END OF THE GROWING SEASON.
- 9.4. SOIL TACKIFIERS MAY BE APPLIED IN ACCORDANCE WITH THE MANUFACTURER'S SPECIFICATIONS AND REAPPLIED AS NECESSARY TO MINIMIZE SOIL AND MULCH LOSS UNTIL PERMANENT VEGETATION IS ESTABLISHED.
10. RETAIN SEDIMENT ON-SITE AND CONTROL DEWATERING PRACTICES:
- 10.1. TEMPORARY SEDIMENT BASINS (CGP-SECTION 2.1.3.2) OR SEDIMENT TRAPS (ENV-WO 1506.10) SHALL BE SIZED TO RETAIN, ON SITE, THE VOLUME OF A 2-YEAR 24-HOUR STORM EVENT FOR ANY AREA OF DISTURBANCE OR 3,600 CUBIC FEET OF STORMWATER RUNOFF PER ACRE OF DISTURBANCE, WHICHEVER IS GREATER. TEMPORARY SEDIMENT BASINS USED TO TREAT STORMWATER RUNOFF FROM AREAS GREATER THAN 5-ACRES OF DISTURBANCE SHALL BE SIZED TO ALSO CONTROL STORMWATER RUNOFF FROM A 10-YEAR 24 HOUR STORM EVENT. ON-SITE RETENTION OF THE 10-YEAR 24-HOUR EVENT IS NOT REQUIRED.
- 10.2. CONSTRUCT AND STABILIZE DEWATERING INFILTRATION BASINS PRIOR TO ANY EXCAVATION THAT MAY REQUIRE DEWATERING.
- 10.3. TEMPORARY SEDIMENT BASINS OR TRAPS SHALL BE PLACED AND STABILIZED AT LOCATIONS WHERE CONCENTRATED FLOW (CHANNELS AND PIPES) DISCHARGE TO THE SURROUNDING ENVIRONMENT FROM AREAS OF UNSTABILIZED EARTH DISTURBING ACTIVITIES.

11. ADDITIONAL EROSION AND SEDIMENT CONTROL GENERAL PRACTICES:
- 11.1. USE TEMPORARY MULCHING, PERMANENT MULCHING, TEMPORARY VEGETATIVE COVER, AND PERMANENT VEGETATIVE COVER TO REDUCE THE NEED FOR DUST CONTROL. USE MECHANICAL SWEEPERS ON PAVED SURFACES WHERE NECESSARY TO PREVENT DUST BUILDUP. APPLY WATER, OR OTHER DUST INHIBITING AGENTS OR TACKIFIERS, AS APPROVED BY THE NHDES.
- 11.2. ALL STOCKPILES SHALL BE CONTAINED WITH TEMPORARY PERIMETER CONTROLS. INACTIVE SOIL STOCKPILES SHOULD BE PROTECTED WITH SOIL STABILIZATION MEASURES (TEMPORARY EROSION CONTROL SEED MIX AND MULCH, SOIL BINDER) OR COVERED WITH ANCHORED TARPS.
- 11.3. EROSION AND SEDIMENT CONTROL MEASURES WILL BE INSPECTED IN ACCORDANCE WITH SECTION 645 OF NHDOT SPECIFICATIONS, WEEKLY AND WITHIN 24 HOURS AFTER ANY STORM EVENT GREATER THAN 0.25 IN. OF RAIN PER 24-HOUR PERIOD. EROSION AND SEDIMENT CONTROL MEASURES WILL ALSO BE INSPECTED IN ACCORDANCE WITH THE GUIDANCE MEMO FROM THE NHDES CONTAINED WITHIN THE CONTRACT PROPOSAL AND THE EPA CONSTRUCTION GENERAL PERMIT.
- 11.4. THE CONTRACTOR SHOULD UTILIZE STORM DRAIN INLET PROTECTION TO PREVENT SEDIMENT FROM ENTERING A STORM DRAINAGE SYSTEM PRIOR TO THE PERMANENT STABILIZATION OF THE CONTRIBUTING DISTURBED AREA.
- 11.5. PERMANENT STABILIZATION MEASURES WILL BE CONSTRUCTED AND MAINTAINED IN LOCATIONS AS SHOWN ON THE CONSTRUCTION PLANS TO STABILIZE AREAS. VEGETATIVE STABILIZATION SHALL NOT BE CONSIDERED PERMANENTLY STABILIZED UNTIL VEGETATIVE GROWTH COVERS AT LEAST 85% OF THE DISTURBED AREA. THE CONTRACTOR SHALL BE RESPONSIBLE FOR EROSION AND SEDIMENT CONTROL FOR ONE YEAR AFTER PROJECT COMPLETION.
- 11.6. CATCH BASINS: CARE SHALL BE TAKEN TO ENSURE THAT SEDIMENTS DO NOT ENTER ANY EXISTING CATCH BASINS DURING CONSTRUCTION. THE CONTRACTOR SHALL PLACE TEMPORARY STONE INLET PROTECTION OVER INLETS IN AREAS OF SOIL DISTURBANCE THAT ARE SUBJECT TO SEDIMENT CONTAMINATION.
- 11.7. TEMPORARY AND PERMANENT DITCHES SHALL BE CONSTRUCTED, STABILIZED AND MAINTAINED IN A MANNER THAT WILL MINIMIZE SCOUR. TEMPORARY AND PERMANENT DITCHES SHALL BE DIRECTED TO DRAIN TO SEDIMENT BASINS OR STORM WATER COLLECTION AREAS.
- 11.8. WINTER EXCAVATION AND EARTHWORK ACTIVITIES NEEDED TO BE LIMITED IN EXTENT AND DURATION, TO MINIMIZE POTENTIAL EROSION AND SEDIMENTATION IMPACTS. THE AREA OF EXPOSED SOIL SHALL BE LIMITED TO ONE ACRE, OR THAT WHICH CAN BE STABILIZED AT THE END OF EACH DAY UNLESS A WINTER CONSTRUCTION PLAN, DEVELOPED BY A QUALIFIED ENGINEER OR A CPESC SPECIALIST, IS REVIEWED AND APPROVED BY THE DEPARTMENT.
- 11.9. CHANNEL PROTECTION MEASURES SHALL BE SUPPLEMENTED WITH PERIMETER CONTROL MEASURES WHEN THE DITCH LINES OCCUR AT THE BOTTOM OF LONG FILL SLOPES. THE PERIMETER CONTROLS SHALL BE INSTALLED ON THE FILL SLOPE TO MINIMIZE THE POTENTIAL FOR FILL SLOPE SEDIMENT DEPOSITS IN THE DITCH LINE.

BEST MANAGEMENT PRACTICES (BMP) BASED ON AMOUNT OF OPEN CONSTRUCTION AREA

12. STRATEGIES SPECIFIC TO OPEN AREAS LESS THAN 5 ACRES:
- 12.1. THE CONTRACTOR SHALL COMPLY WITH RSA 485:A:17 AND ENV-WO 1500: ALTERATION OF TERRAIN FOR CONSTRUCTION AND USE ALL CONVENTIONAL BMP STRATEGIES.
- 12.2. SLOPES STEEPER THAN 3:1 WILL RECEIVE TURF ESTABLISHMENT WITH MATTING.
- 12.3. SLOPES 3:1 OR FLATTER WILL RECEIVE TURF ESTABLISHMENT ALONE.
- 12.4. AREAS WHERE HAUL ROADS ARE CONSTRUCTED AND STORMWATER CANNOT BE TREATED THE DEPARTMENT WILL CONSIDER INFILTRATION.
- 12.5. FOR HAUL ROADS ADJACENT TO SENSITIVE ENVIRONMENTAL AREAS OR STEEPER THAN 5%, THE DEPARTMENT WILL CONSIDER USING EROSION STONE, CRUSHED GRAVEL, OR CRUSHED STONE BASE TO HELP MINIMIZE EROSION ISSUES.
- 12.6. ALL AREAS THAT CAN BE STABILIZED SHALL BE STABILIZED PRIOR TO OPENING UP NEW TERRITORY.
- 12.7. DETENTION BASINS SHALL BE DESIGNED AND CONSTRUCTED TO ACCOMMODATE A 2 YEAR STORM EVENT.
13. STRATEGIES SPECIFIC TO OPEN AREAS BETWEEN 5 AND 10 ACRES:
- 13.1. THE CONTRACTOR SHALL COMPLY WITH RSA 485:A:17 AND ENV-WO 1500 ALTERATION OF TERRAIN AND SHALL USE CONVENTIONAL BMP STRATEGIES AND ALL TREATMENT OPTIONS USED FOR UNDER 5 ACRES WILL BE UTILIZED.
- 13.2. DETENTION BASINS WILL BE CONSTRUCTED TO ACCOMMODATE THE 2-YEAR 24-HOUR STORM EVENT AND CONTROL A 10-YEAR 24-HOUR STORM EVENT.
- 13.3. SLOPES STEEPER THAN A 3:1 WILL RECEIVE TURF ESTABLISHMENT WITH MATTING OR OTHER TEMPORARY SOIL STABILIZATION MEASURES DETAILED IN TABLE 1. THE CONTRACTOR MAY ALSO CONSIDER A SOIL BINDER IN ACCORDANCE WITH THE NHDES APPROVALS OR REGULATIONS. OTHER ALTERNATIVE MEASURES, SUCH AS BONDED FIBER MATRICES (BFMS) OR FLEXIBLE GROWTH MEDIUMS (FGMS) MAY BE UTILIZED, IF MEETING THE NHDES APPROVALS AND REGULATIONS.
- 13.4. SLOPES 3:1 OR FLATTER WILL RECEIVE TURF ESTABLISHMENT OR OTHER TEMPORARY SOIL STABILIZATION MEASURES DETAILED IN TABLE 1. THE CONTRACTOR MAY ALSO CONSIDER A SOIL BINDER IN ACCORDANCE WITH THE NHDES APPROVALS OR REGULATIONS.
14. STRATEGIES SPECIFIC TO OPEN AREAS OVER 10 ACRES:
- 14.1. THE CONTRACTOR SHALL COMPLY WITH RSA 485:A:17 AND ENV-WO 1500 ALTERATION OF TERRAIN AND SHALL USE CONVENTIONAL BMP STRATEGIES AND ALL TREATMENT OPTIONS USED FOR UNDER 5 ACRES AND BETWEEN 5 AND 10 ACRES WILL BE UTILIZED.
- 14.2. THE DEPARTMENT ANTICIPATES THAT SOIL BINDERS WILL BE NEEDED ON ALL SLOPES STEEPER THAN 3:1, IN ORDER TO MINIMIZE EROSION AND REDUCE THE AMOUNT OF SEDIMENT IN THE STORMWATER TREATMENT BASINS.
- 14.3. THE CONTRACTOR WILL BE REQUIRED TO HAVE AN APPROVED DESIGN IN ACCORDANCE WITH ENV-WO 1506.12 FOR AN ACTIVE FLOCCULANT TREATMENT SYSTEM TO TREAT AND RELEASE WATER CAPTURED IN STORM WATER BASINS. THE CONTRACTOR SHALL ALSO RETAIN THE SERVICES OF AN ENVIRONMENTAL CONSULTANT WHO HAS DEMONSTRATED EXPERIENCE IN THE DESIGN OF FLOCCULANT TREATMENT SYSTEMS. THE CONSULTANT WILL ALSO BE RESPONSIBLE FOR THE IMPLEMENTATION AND MONITORING OF THE SYSTEM.

TABLE 1
GUIDANCE ON SELECTING TEMPORARY SOIL STABILIZATION MEASURES

APPLICATION AREAS	DRY MULCH METHODS				HYDRAULICALLY APPLIED MULCHES ²				ROLLED EROSION CONTROL BLANKETS ³			
	HMT	WC	SG	CB	HM	SMM	BFM	FRM	SNSB	DNSB	DNSCB	DNCB
SLOPES ¹												
Steeper than 2:1	NO	NO	YES	NO	NO	NO	NO	YES	NO	NO	NO	YES
2:1 Slope	YES	YES	YES	YES	NO	NO	YES	YES	NO	YES	YES	YES
3:1 Slope	YES	YES	YES	YES	NO	YES	YES	YES	YES	YES	YES	NO
4:1 Slope	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	NO	NO
Winter Stabilization	4T/AC	YES	YES	YES	NO	NO	YES	YES	YES	YES	YES	YES
CHANNELS												
LOW FLOW CHANNELS	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES
HIGH FLOW CHANNELS	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES

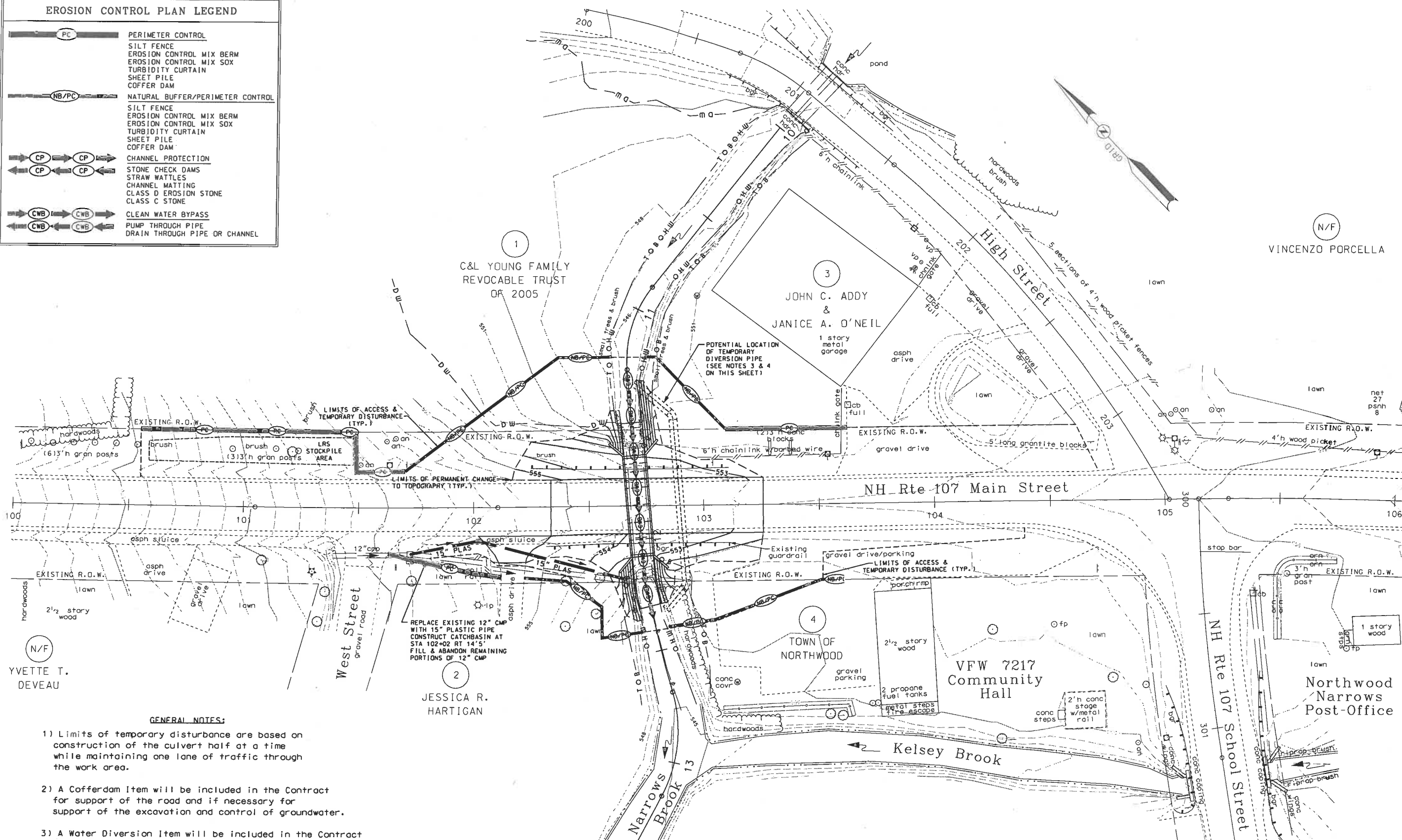
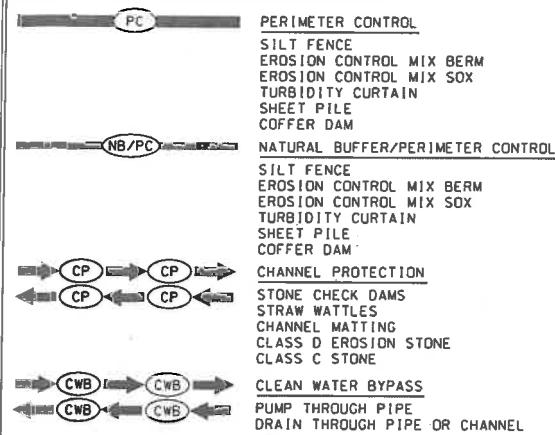
ABBREV.	STABILIZATION MEASURE	ABBREV.	STABILIZATION MEASURE	ABBREV.	STABILIZATION MEASURE
HMT	HAY MULCH & TACK	HM	HYDRAULIC MULCH	SNSB	SINGLE NET STRAW BLANKET
WC	WOOD CHIPS	SMM	STABILIZED MULCH MATRIX	DNSB	DOUBLE NET STRAW BLANKET
SG	STUMP GRINDINGS	BFM	BONDED FIBER MATRIX	DNSCB	2 NET STRAW-COCONUT BLANKET
CB	COMPOST BLANKET	FRM	FIBER REINFORCED MEDIUM	DNCB	2 NET COCONUT BLANKET

- NOTES:
1. ALL SLOPE STABILIZATION OPTIONS ASSUME A SLOPE LENGTH \leq 10 TIMES THE HORIZONTAL DISTANCE COMPONENT OF THE SLOPE, IN FEET.
2. PRODUCTS CONTAINING POLYACRYLAMIDE (PAM) SHALL NOT BE APPLIED DIRECTLY TO OR WITHIN 100 FEET OF ANY SURFACE WATER WITHOUT PRIOR WRITTEN APPROVAL FROM THE NH DEPARTMENT OF ENVIRONMENTAL SERVICES.
3. ALL EROSION CONTROL BLANKETS SHALL BE MADE WITH WILDLIFE FRIENDLY BIODEGRADABLE NETTING.

STATE OF NEW HAMPSHIRE NORTHWOOD				
DEPARTMENT OF TRANSPORTATION • BUREAU OF HIGHWAY DESIGN				
EROSION CONTROL STRATEGIES				
REVISION DATE	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
12-21-2015	erosstrat	42363	8	9

[illegible]

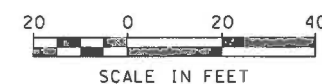
EROSION CONTROL PLAN LEGEND



GENERAL NOTES:

- 1) Limits of temporary disturbance are based on construction of the culvert half at a time while maintaining one lane of traffic through the work area.
- 2) A Cofferdam Item will be included in the Contract for support of the road and if necessary for support of the excavation and control of groundwater.
- 3) A Water Diversion Item will be included in the Contract for managing surface water. Stream flow shall be passed through the work area by an approved method. At a minimum, the Water Diversion shall be designed to pass the 2 year storm.
- 4) Cofferdam and water diversion details are designed by the Contractor and submitted to NHDOT for approval.

CONTOUR INTERVAL = 1 FOOT



STATE OF NEW HAMPSHIRE NORTHWOOD			
DEPARTMENT OF TRANSPORTATION • BUREAU OF HIGHWAY DESIGN			
<i>EROSION CONTROL PLANS</i>			
DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
42363ercplans	42363	9	9